TECHNOLOGY DEPT.

Gas Journal

VOL. 284. 107th YEAR. LONDON, NOVEMBER 16, 1955 No. 4824 PRICE 1/6

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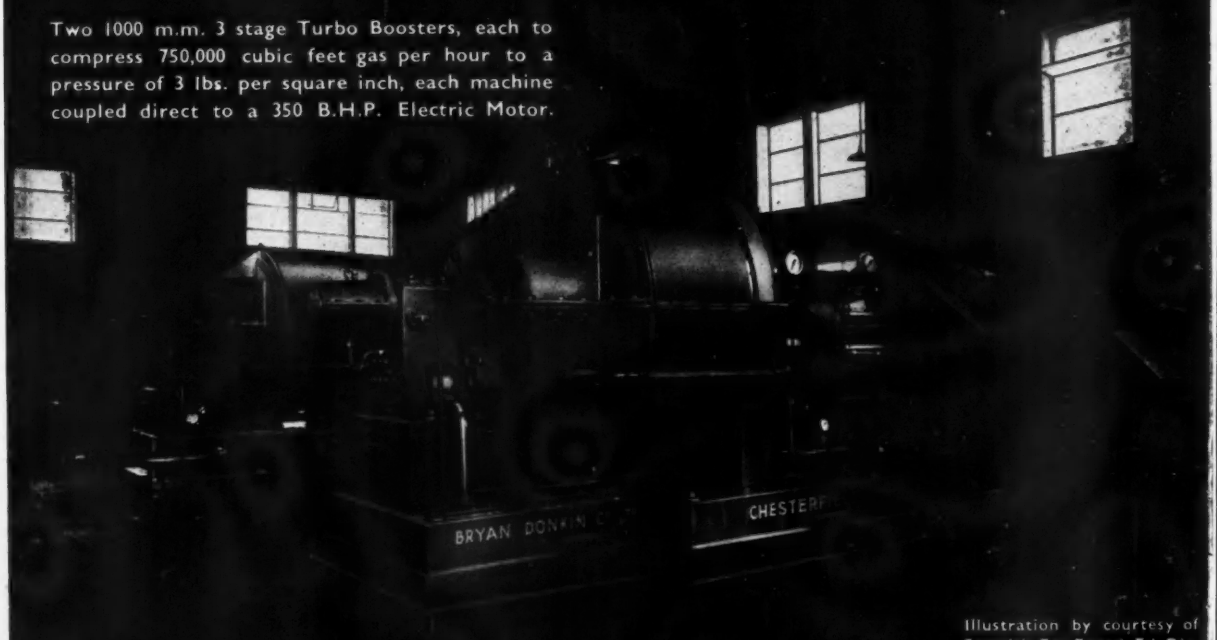

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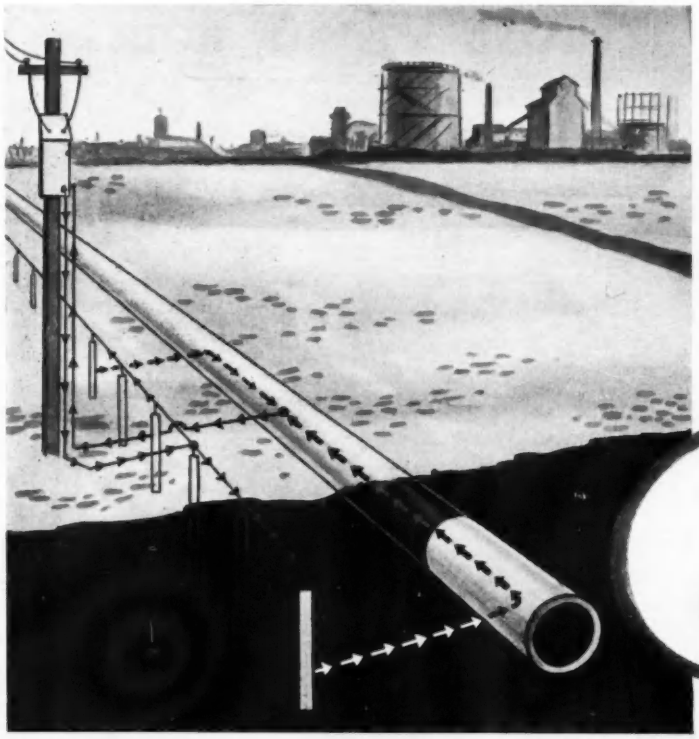

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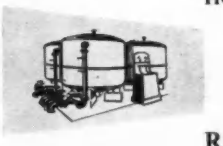

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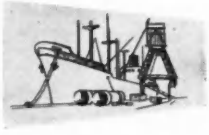

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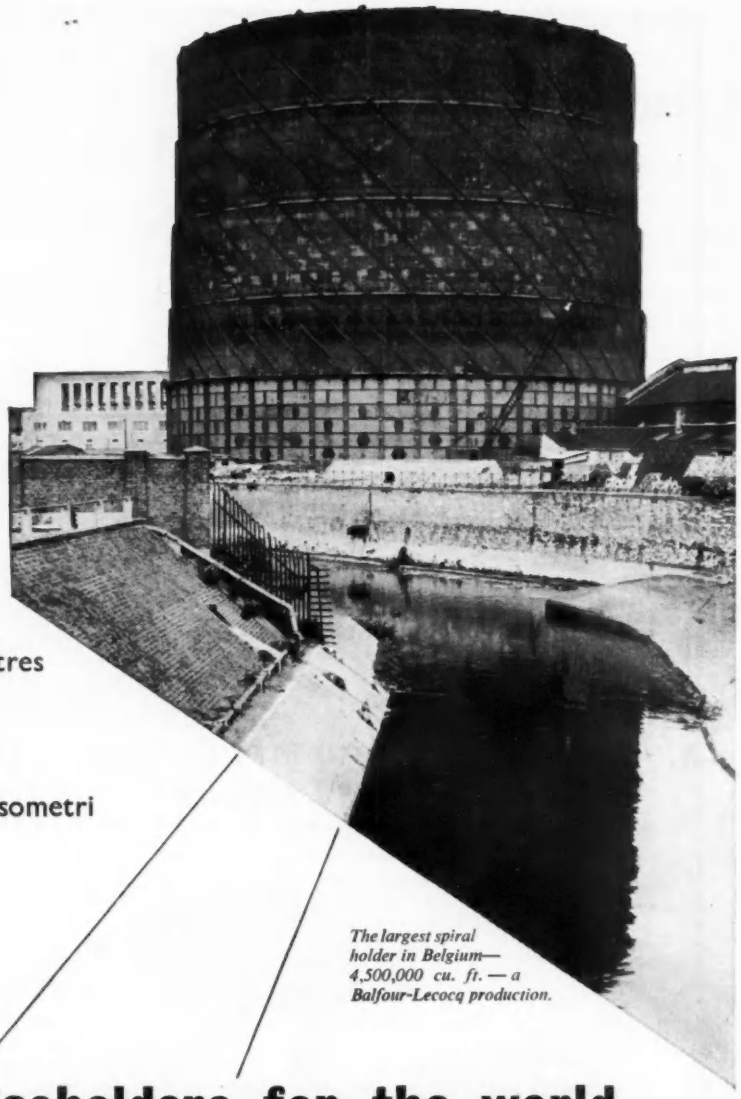

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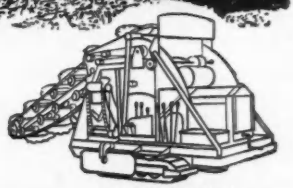

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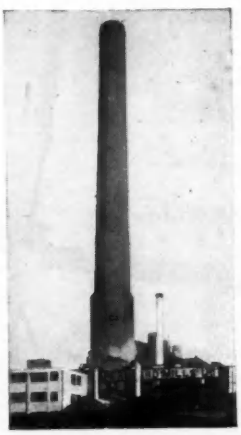
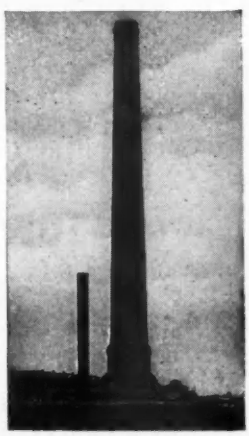
Left : Trial borings for reconstruction of Coventry Cathedral.





Two of the largest chimneys in the British Isles; on foundations of Francois Concrete Piles (left) and Francois Cementation Piles (Right)

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the neat, strong pre-tinned capillary fitting for domestic installations including gasfitting

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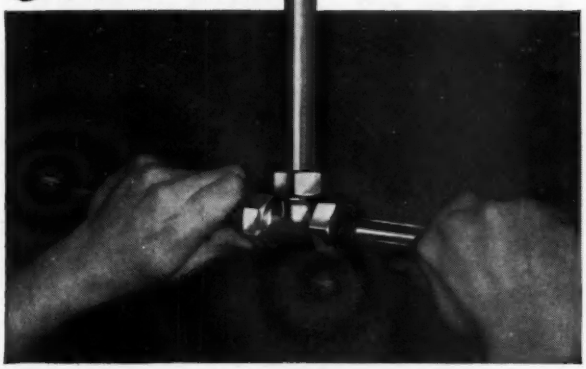
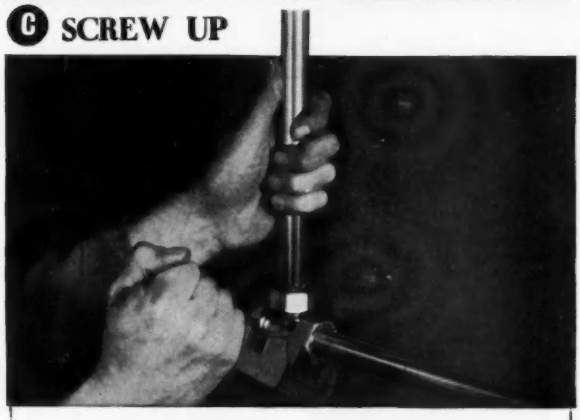


B TIGHTEN

C SCREW UP



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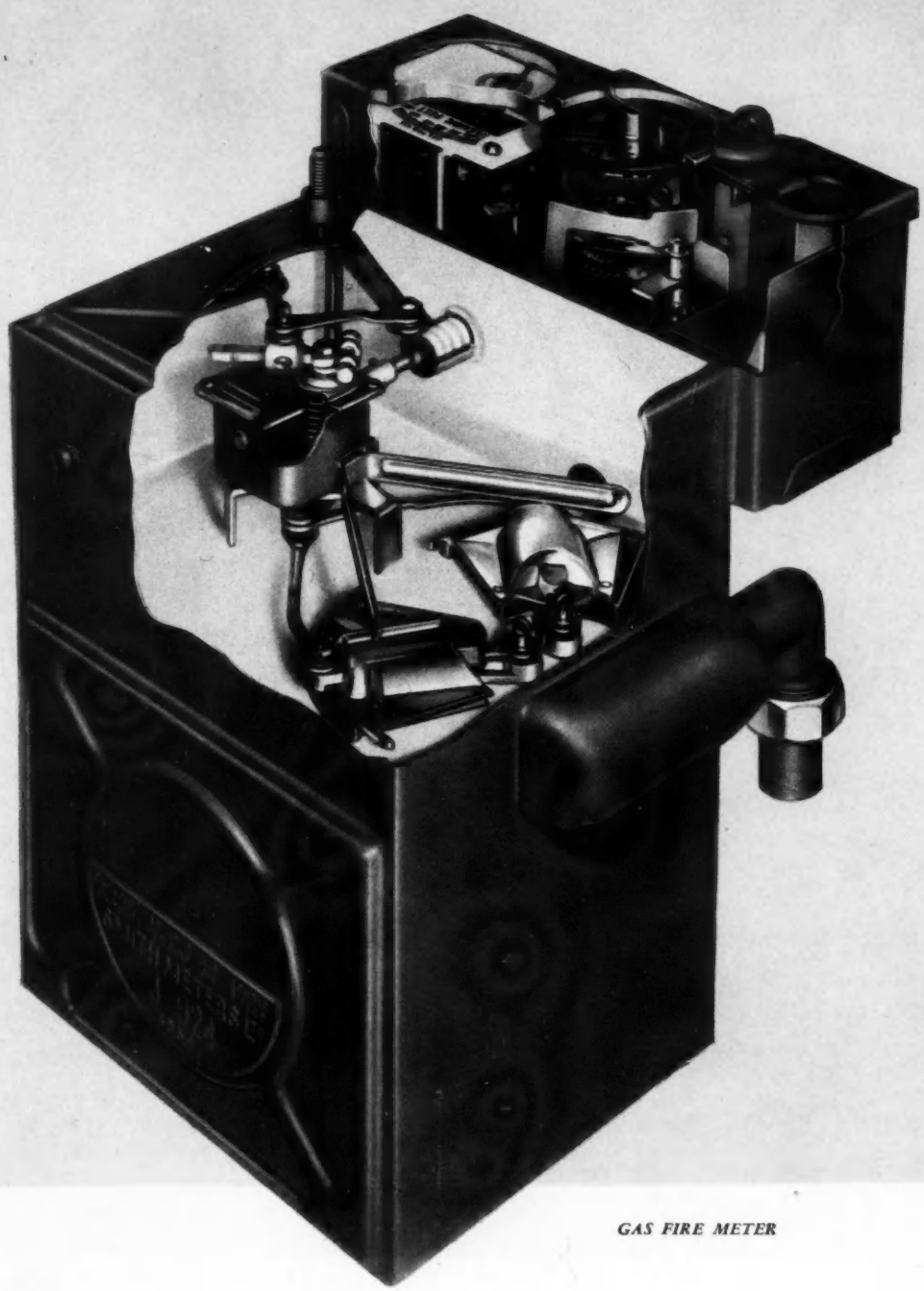

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The gas lamp shown here is of a type that came in during the 'Fifties' and survived with little change for many years. It had an iron burner that corroded easily, until Sugg, in 1858, devised a burner of non-corrodible steatite. Bunsen's burner, invented in 1855, was designed for heating, but before long was adapted for use with the familiar incandescent gas mantle.

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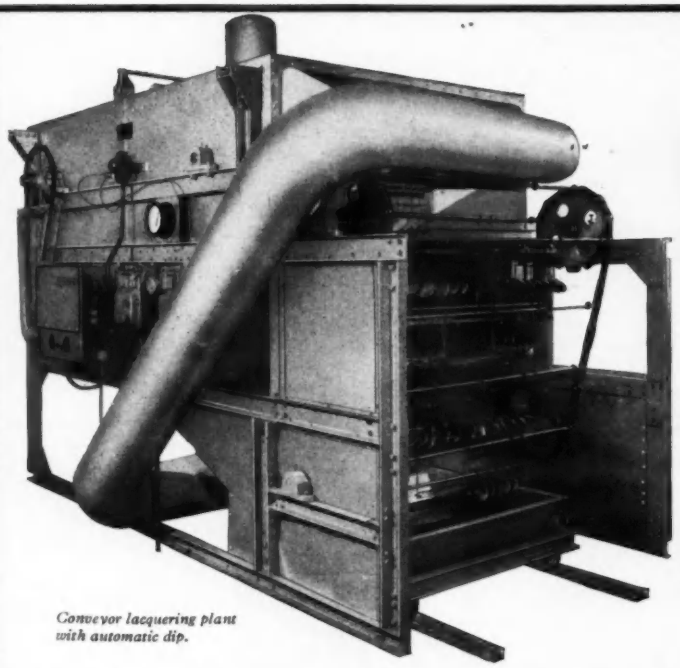

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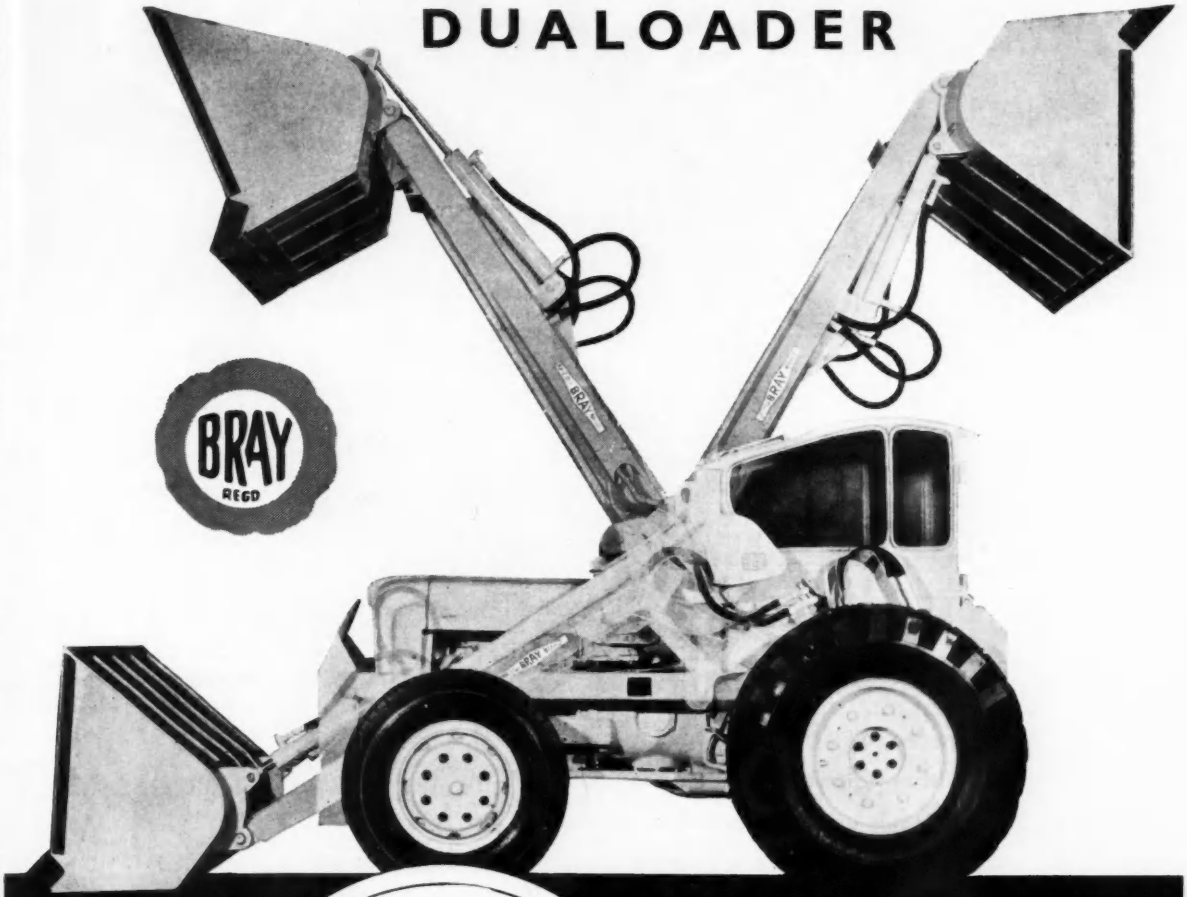

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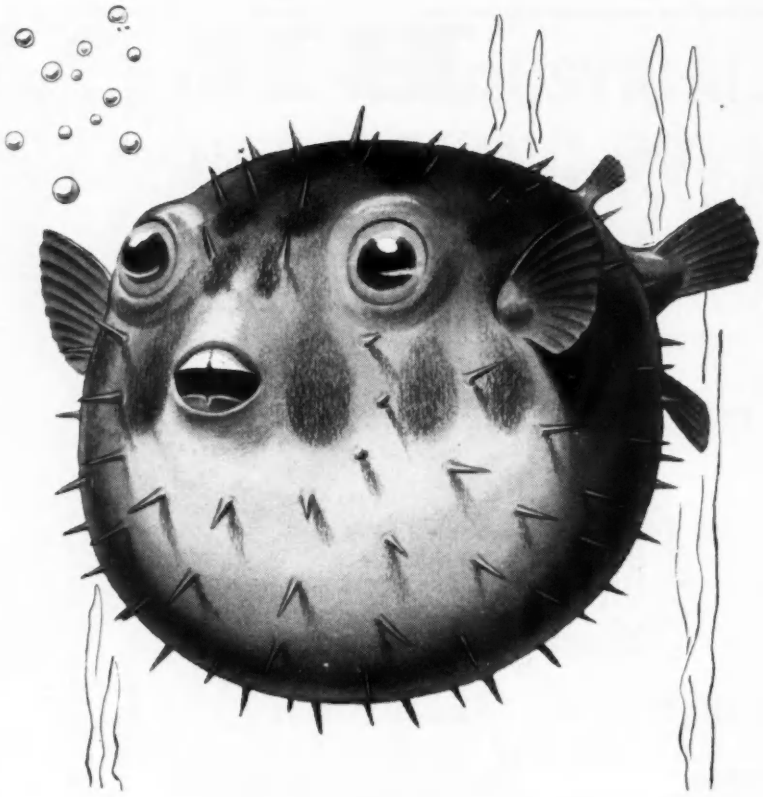

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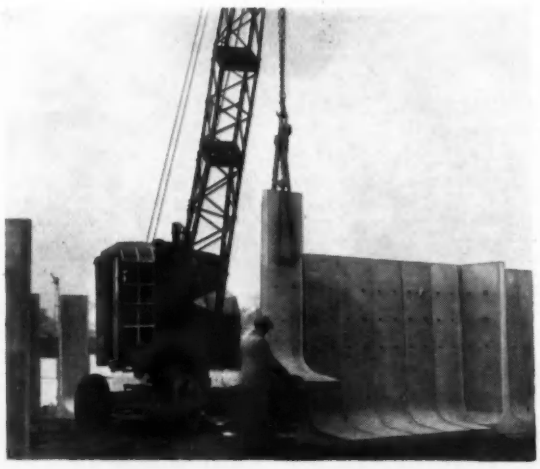

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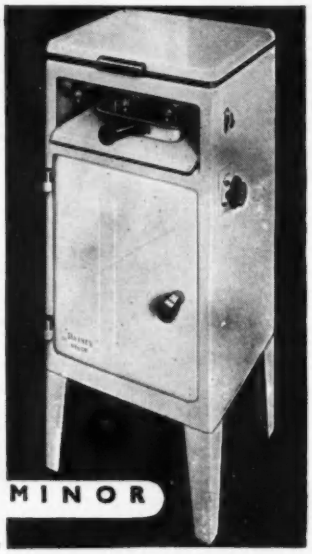

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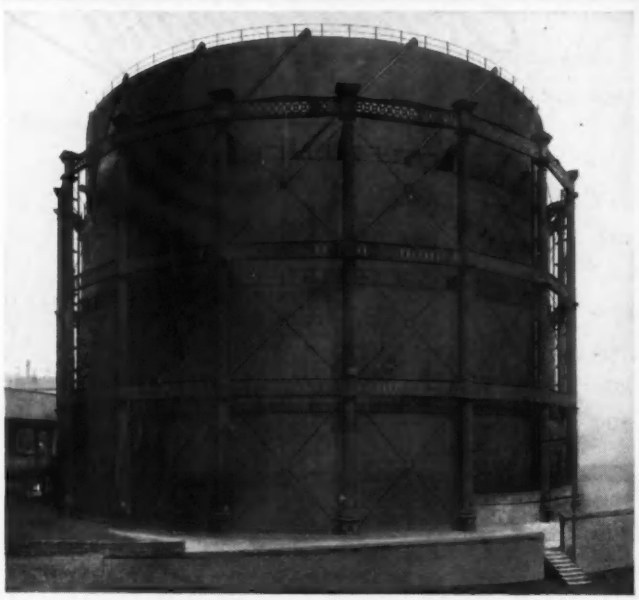

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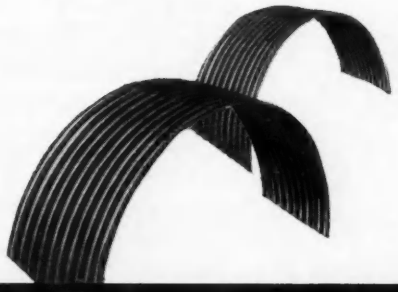
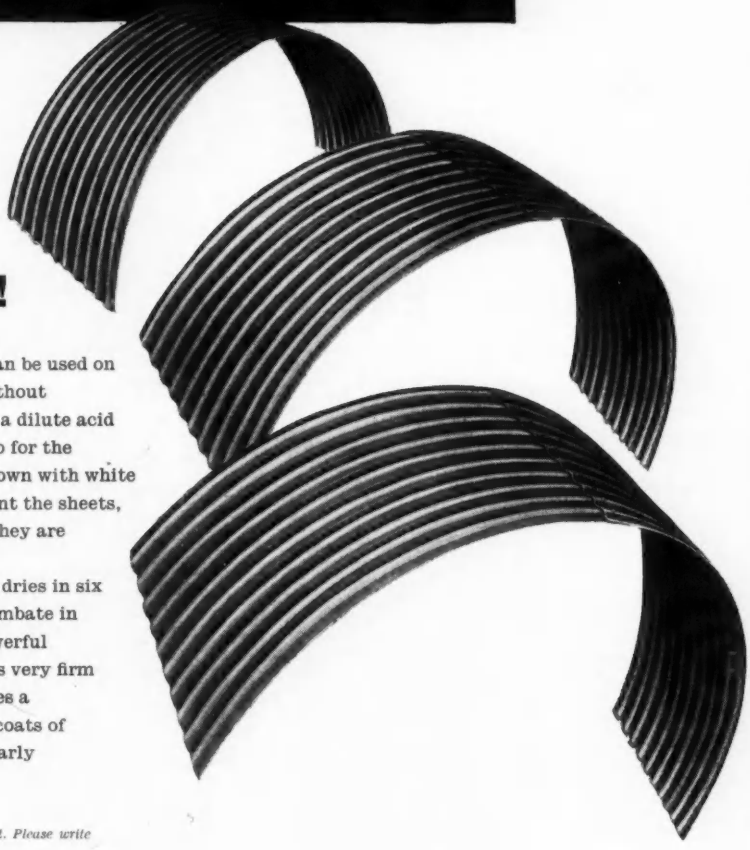


RUSTODIAN GOES ON NEW GALVANIZING



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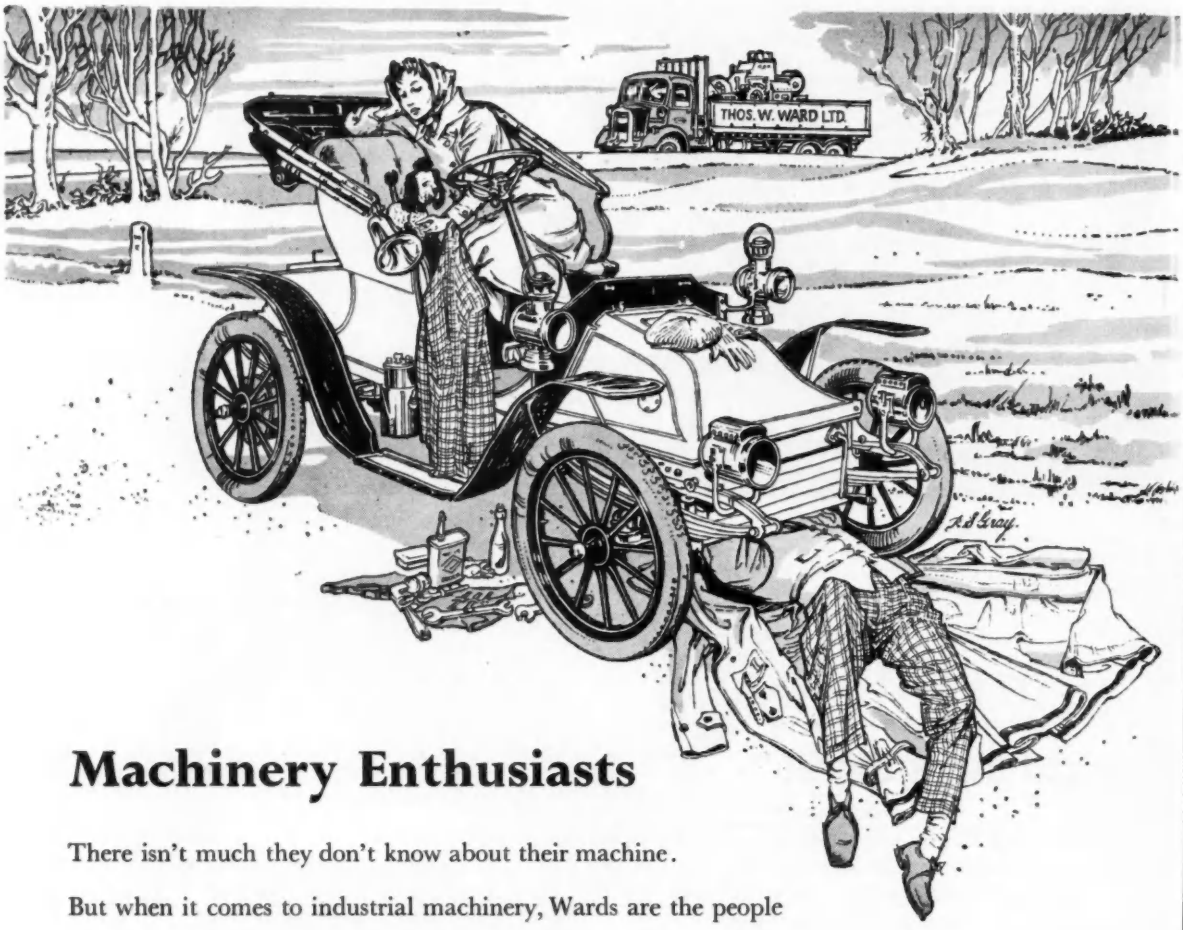

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COKE OVEN DOORS

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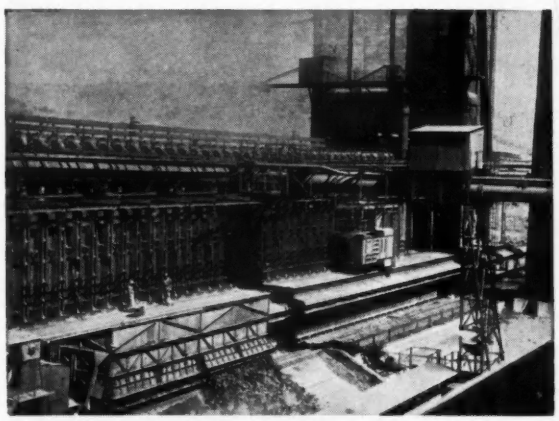
Shelton Iron & Steel Co. Ltd., Refractory Concrete door linings ready for installation.



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South Eastern Gas Board, East Greenwich Gas Works, Lining coke oven door in situ

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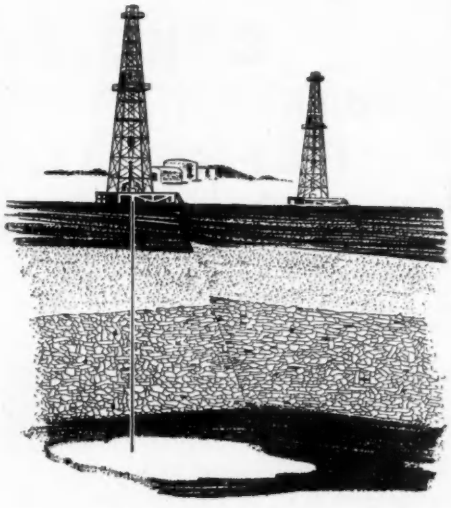

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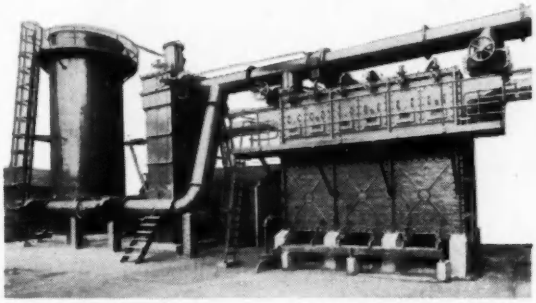
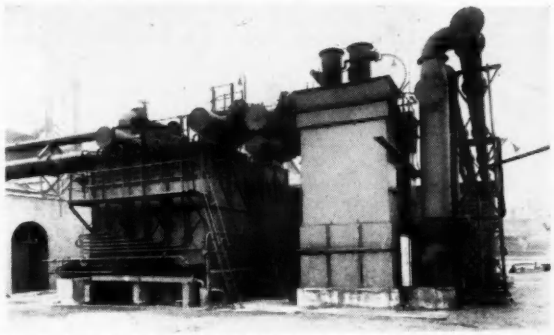
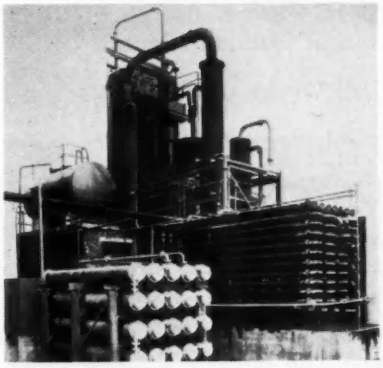


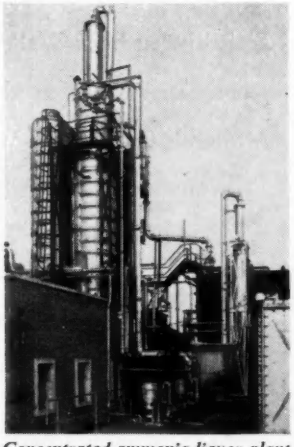
Wet purification plant comprising mild steel condenser, cast iron ammonia washer and plate-type electro-detarrer at Norwich for Eastern Gas Board.



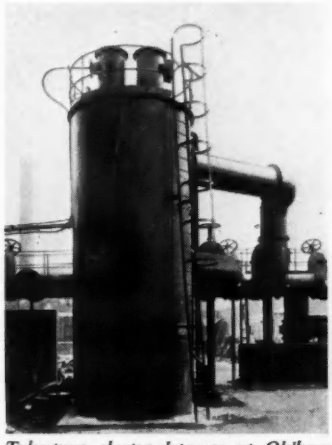
Washers and detarrers at New Wortley for North Eastern Gas Board.



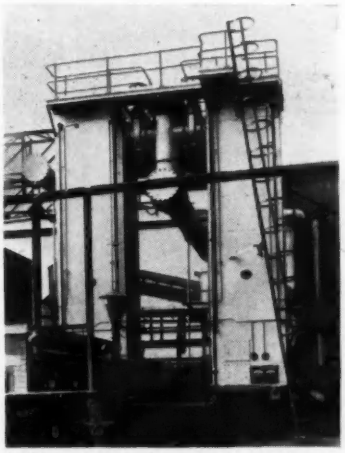
Effluent liquor treatment plant for Southern Gas Board.



Concentrated ammonia liquor plant at Bristol for South Western Gas Board.



Tube-type electro-detarrer at Oldham for North Western Gas Board.



Mild steel vertical water-tube condensers at Bristol (Canon's Marsh Gasworks) for the South Western Gas Board.

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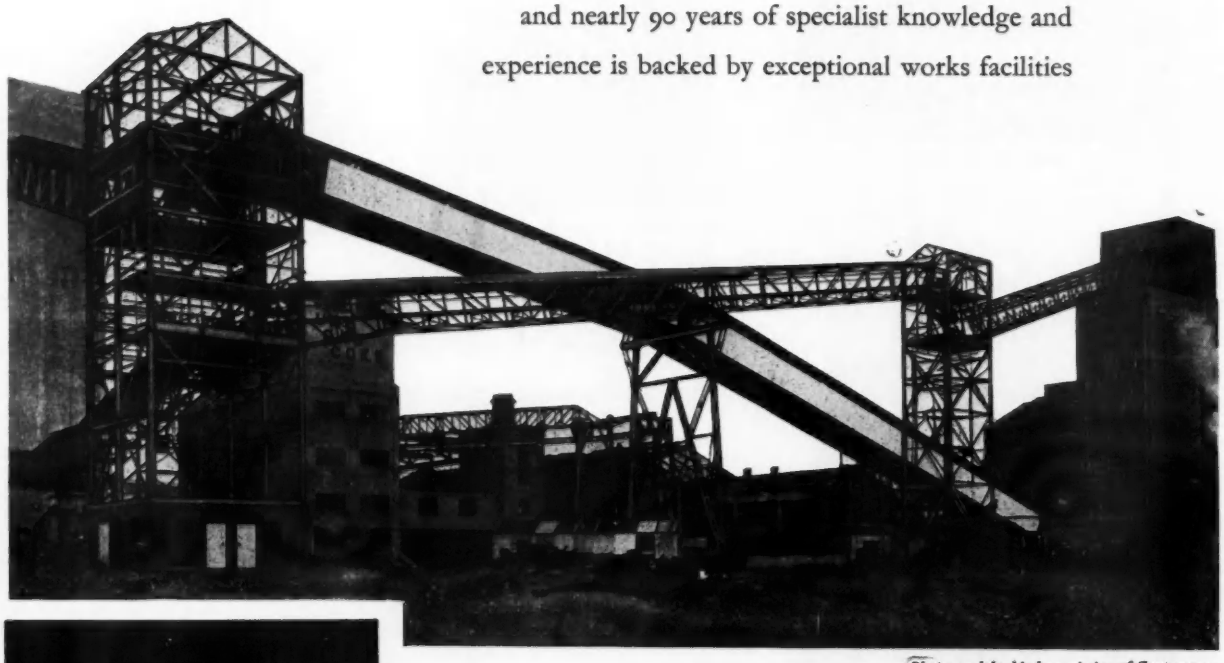

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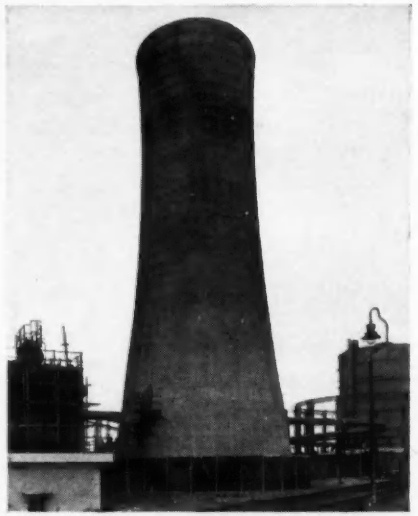
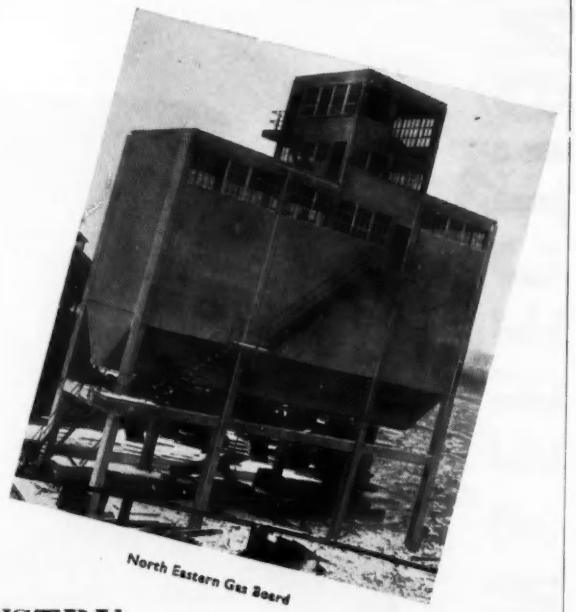


North Thames Gas Board



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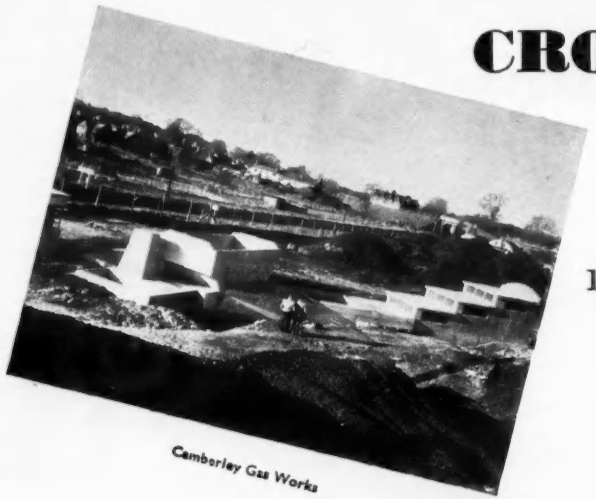
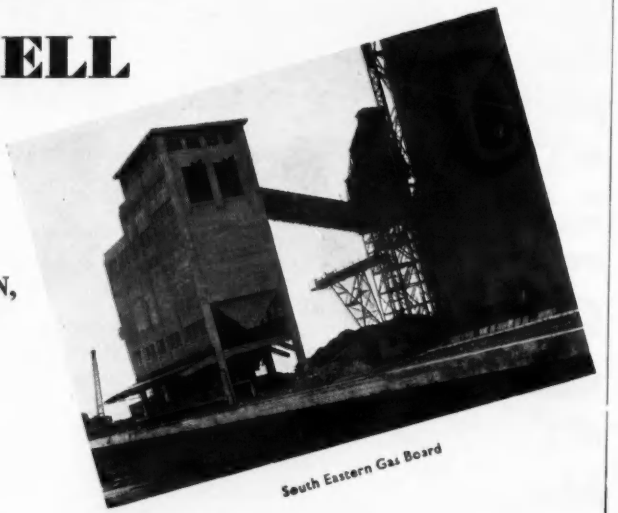


Camberley Gas Works



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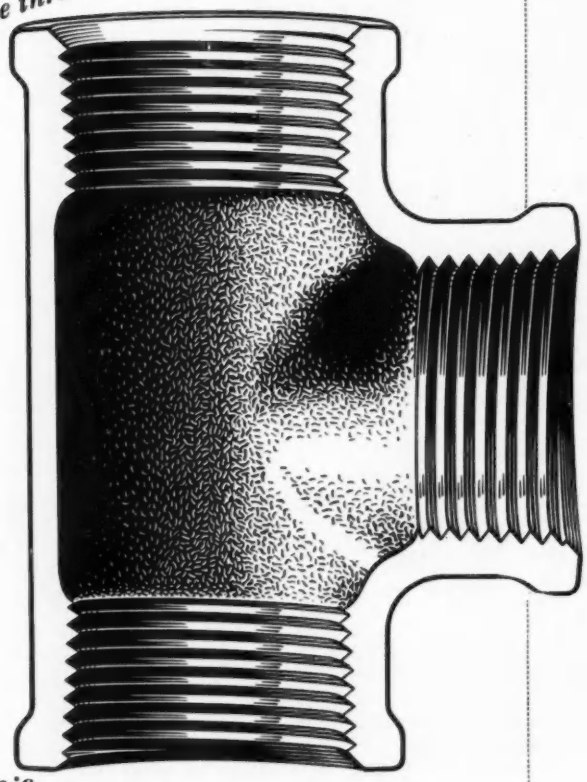

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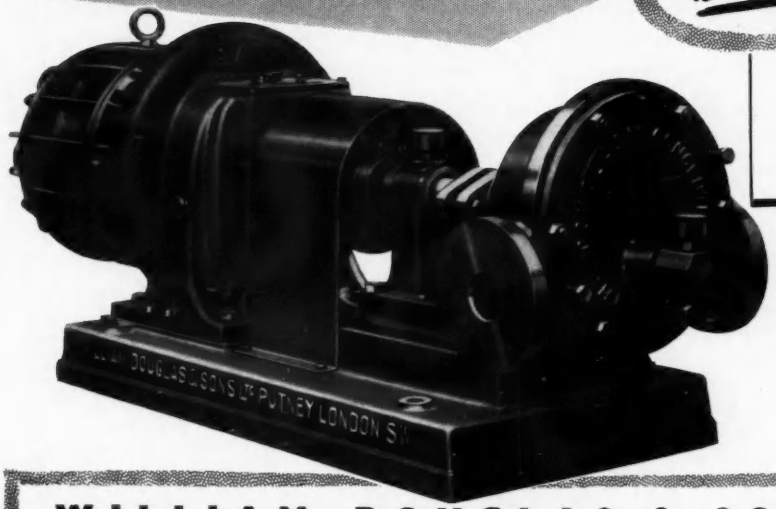

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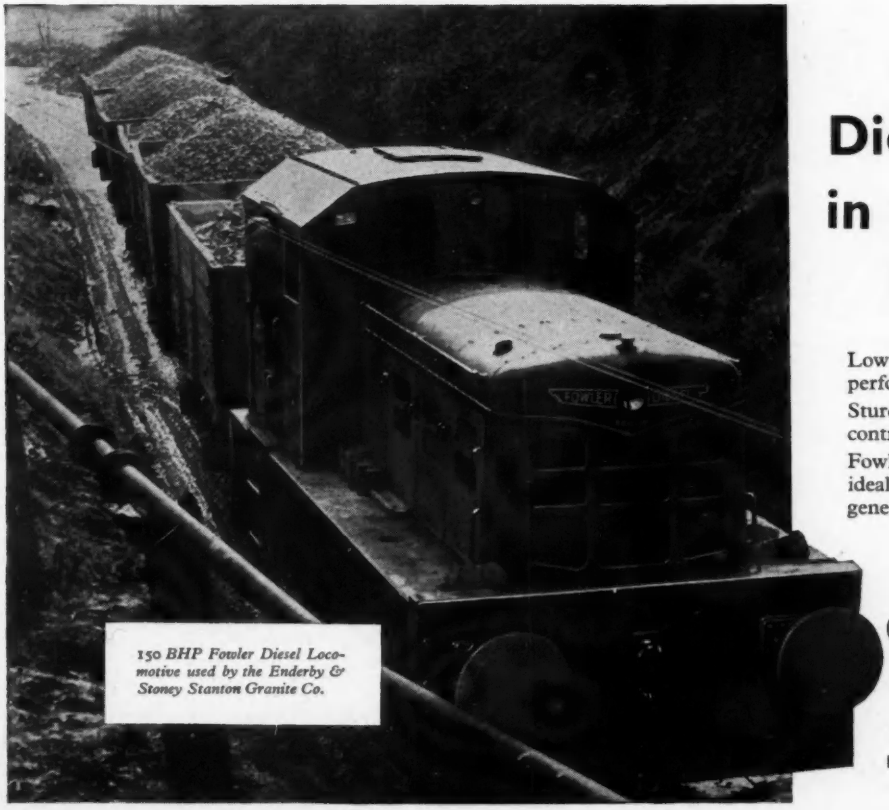

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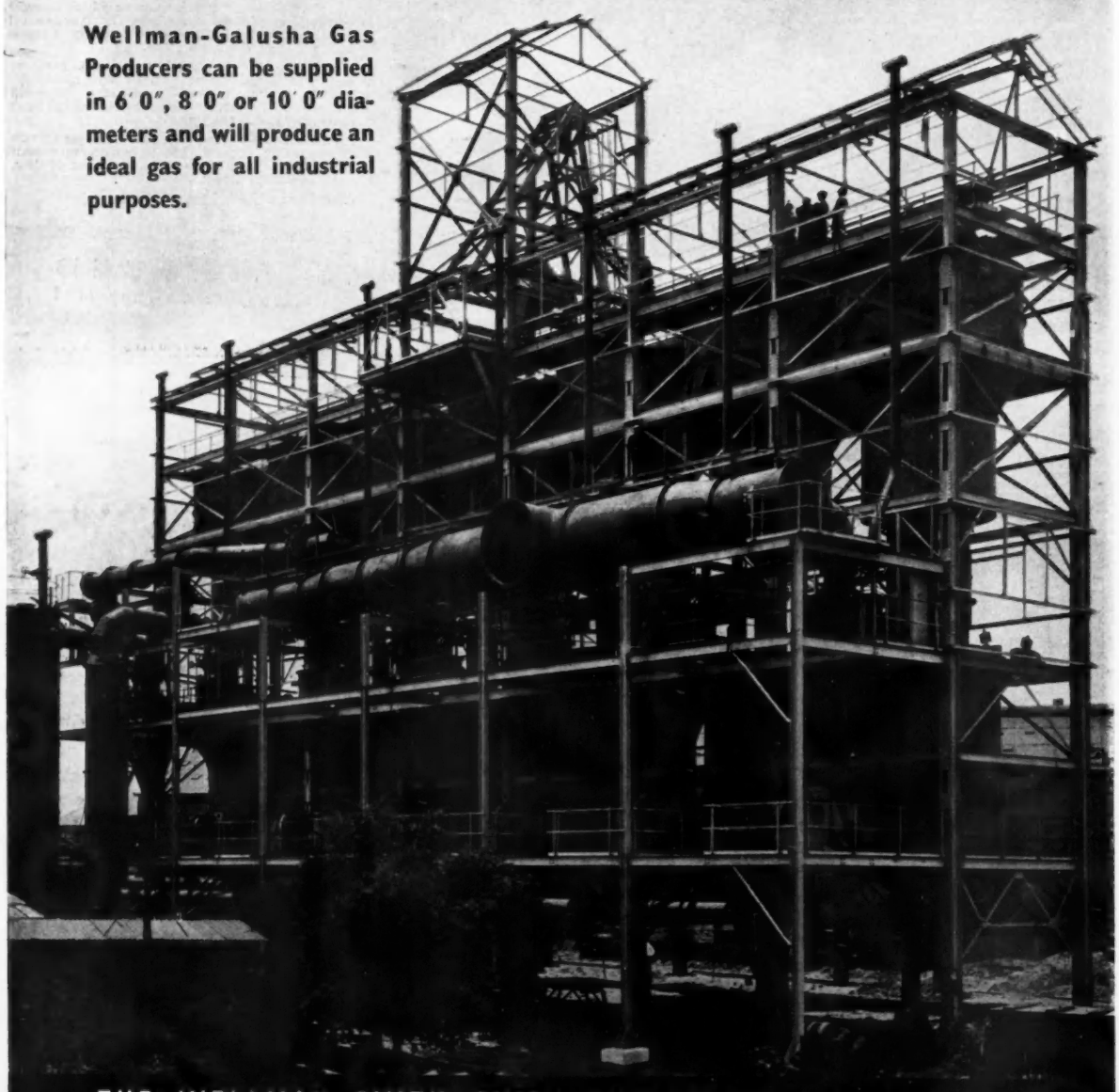

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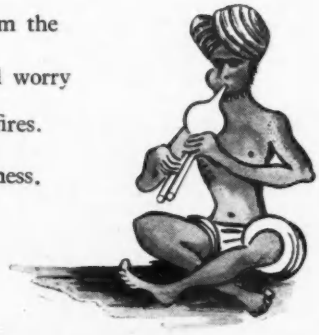

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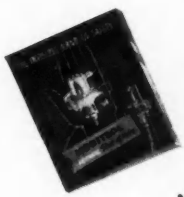

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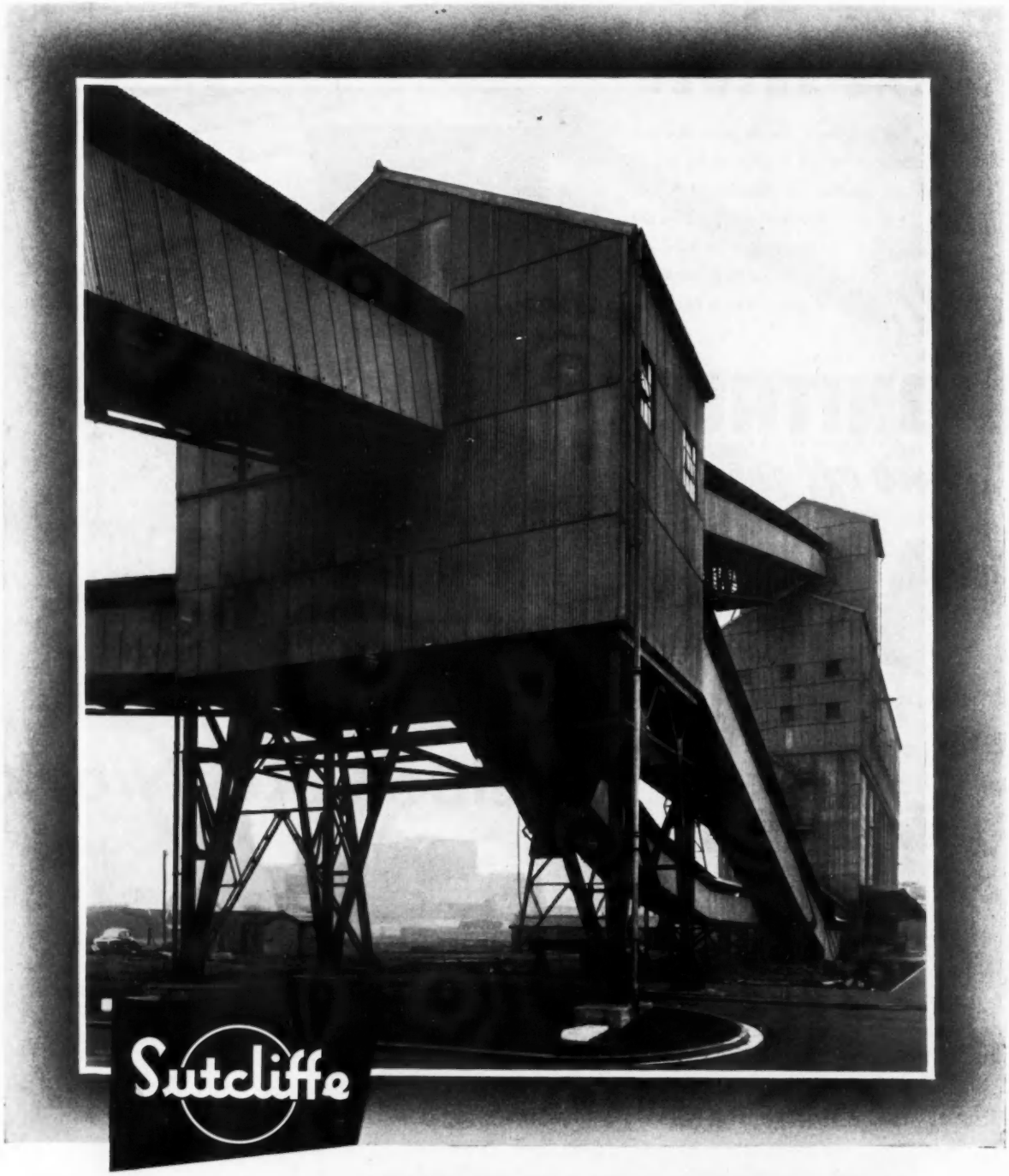

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The illustration shows a conveyor junction house at the Bromley-by-Bow works of the North Thames Gas Board. This is part of a system of 28 conveyors with ancillary screens, feeders, chutes and hoppers handling coal and coke.

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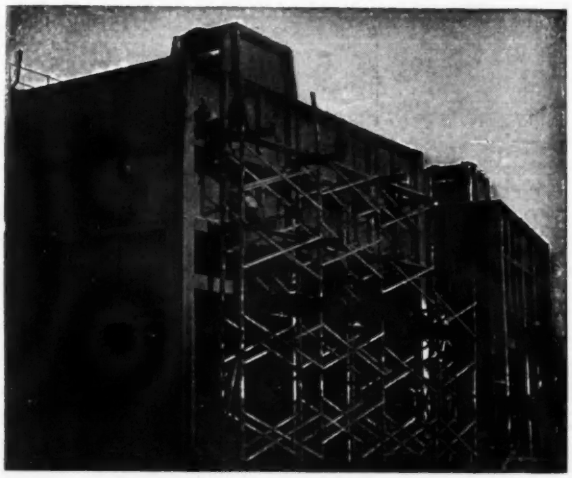

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Gas Journal

VOL. 284 NO. 4824 November 16, 1955

107TH YEAR

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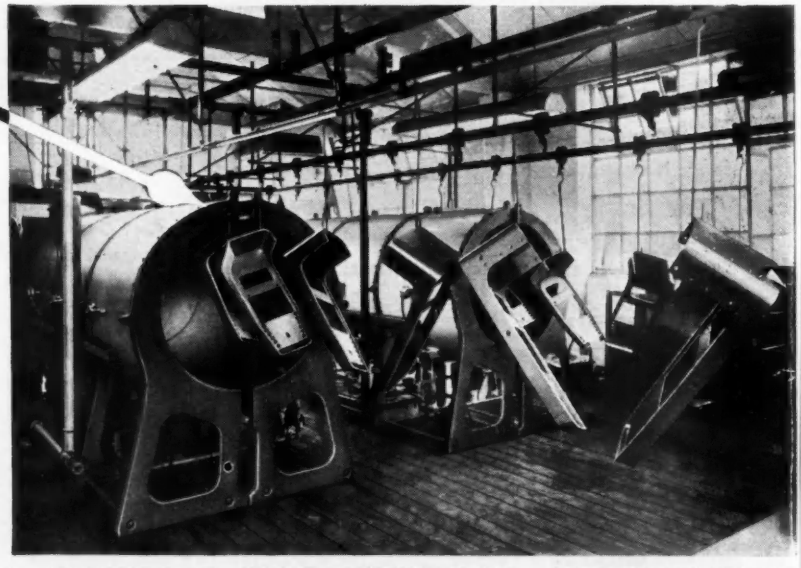

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Gas Journal

VOLUME 284. No. 4824. NOVEMBER 16, 1955. 107th YEAR

An Ill-considered Attack

IT seems rather late in the day for sweeping generalizations flatly contradicting the conclusions of the elaborate research which culminated in the Beaver Report. Yet no less a platform than the correspondence columns of *The Times* has been chosen by a Dr. Godsalve Ward, to express opinions on clean air which appear to have little thought behind them and less fact. All that can be said in this unfortunate letter's favour is that, as we will point out later, it reveals a state of mind that might well be prevalent among the medical profession. Then, it is up to the gas industry to correct those impressions which are false.

First, Dr. Godsalve Ward's letter. It charged that the public are being misled over 'this clear air agitation.' It seemed to be regarded as a health measure—but it was nothing of the sort, except in the very heavily laden areas. 'Smog,' continued the letter, 'is fog which has descended with soot and sulphur acids in solution from the upper air. *The carbon part does not matter at all.*' The letter reads: 'All townsmen's lungs are black from carbon deposit, which is quite innocuous. In fact soot, after a few months' exposure to the air, is a good garden fertilizer. If it was not for the sulphur I imagine the Black Country would be a green and fertile land. The sulphur acids in smog are what do the damage. The Beaver Report does not touch them. We shall get just as many fogs, and just as many chronic bronchitics and asthmatics will die. You get just as much sulphur emitted from burning coke or oil as coal; in fact more, I believe.'

Dr. Godsalve Ward then turned his heavy hand to attack gas and coke fires. 'We doctors always turn gas and coke fires out of sick rooms, especially for chest cases,' he wrote, 'There is only one way to get warmth and ventilation, apart from central heating and conditioned air, and that is by a coal fire. The Beaver Report condemns them on their numbers.'

Even an intelligent layman must agree that this approach towards gas and coke fires seems remarkably superficial for one so learned as a doctor of medicine. Fortunately, we believe that *The Times* correspondence columns are read consistently by a regular following, and they would have seen the next day a short, sharp repudiation by no less a personality than Mr. Arnold Marsh, O.B.E., Director of the National Smoke Abatement Society, who turned his scorn upon what he called the doctor's 'extraordinarily ill-informed letter.' And there is no need to look any further for the answers. Mr. Marsh's points were: (1) That health deteriorated through the use of coke fires was absurd, as thousands of users would testify. Coke was simply coal with the smoke-producing volatile matter removed. A coal fire, in its useful incandescent stage, was simply a coke fire. Did Dr. Godsalve Ward suggest that in this case the part was greater than the whole? (2) There was ample evidence to show that the sulphur acids evolved from most fuels were much more harmful when they were associated with the carbonaceous and tarry particles of smoke. (3) A great deal of the harm done, and the money wasted, because of air pollution was due to the visible smoke alone. Even the smog to which Dr. Godsalve Ward had referred persisted longer and became more concentrated because its blackness impeded the penetration of the sun's warmth. Mr. Marsh ended his reply by saying that he had no doubt that the more medical aspects of the letter would be dealt with very adequately by some of the medical men who had studied the problem.

What is very much to the point is whether Dr. Godsalve Ward's attitude towards gas and coke appliances is representative of the medical profession as a whole. If that is so an otherwise responsible body of men are spreading a malicious and unfounded lie—albeit unintentionally—and the gas industry must see to it that this weak spot in its public relations is made whole.

We have further reason to believe that much misconception about the gas industry's appliances and fuels might be rife among the medical profession. In a telephone interview with the 'GAS JOURNAL' the British Medical Association admitted that Dr. Godsalve Ward's letter was 'rather sweeping' when it referred to the turning out of gas and coke fires from sick rooms. There was no 'general warning' on this. It depended entirely upon the ventilation arrangements of a particular room. But, we were told, 'It would be generally preferable not to use gas and coke fires in sick rooms because of the fumes which are given off.' It is hardly necessary to point out that the B.M.A. is the key body of the registered medical profession. Therefore, only the most drastic measures can presumably combat this kind of anti-gas propaganda, administered as it probably is with the National Health prescription, by people looked upon by the public as omniscient.

SPACE-HEATING IN LARGE BUILDINGS

'THE heating of buildings of great height is a problem which has not yet been satisfactorily solved especially when they have walls of great thickness', so writes M. A. Missenard in a paper, 'New Principles of Heating in Large Buildings' reported in the proceedings of the Ste des Ingéneurs Civils de France, July-August, 1955. In order to obtain an agreeable air temperature it would be necessary to heat the whole mass of the building and this would require whole days of heating prior to the time when the temperature was required, or overheating on a considerable scale. Further, while all that was required was to establish this temperature over a height of some six feet from the floor, one would have to heat the total air content of the building. For this reason many great buildings, such as cathedrals, are not heated at all, because, apart from the cost of the plant the cost of running it would be prohibitive in view of the 'low density of occupation'. Technicians are driven to some system of localized heating, to the establishment of comfortable conditions over a restricted area of the total.

Several methods have been suggested. Some engineers have suggested the injection of heated air under the feet of occupants in the area, but the volume of hot air required is considerable and the heat is dissipated into the surrounding atmosphere. Recent solutions have taken the form of localized heating from high temperature surfaces with directed radiation, particularly what is known as 'infra-red' radiation. The appliances are placed at a height above the floor. However, it is difficult to avoid loss by convection and the heat is directed to the heads of occupants rather than to their bodies and feet. When gas is used as the fuel, in a closed space air may be vitiated by the products of combustion. 'The essential problem in localized heating is to obtain a comfortable temperature at the level of the feet'. The solution of the problem put forward by M. Missenard is the obvious one, to heat the floor in sectionalized areas so that one or more of these can be heated as required. It is as simple as that! After preliminary investigation with 'calorimeters', not unlike those used by Dr. Fishenden in her classic work on the effect on the person of various forms of room-heating, an experiment was carried out in the great Basilica of Saint Quentin where 'the faithful' sit in the same place during 'the office' for about an hour. Here there are about 44 chairs in an area five metres by four. The tests were carried out on six consecutive Sundays in January and February last. In the concrete floor were embedded tubes through which circulated water heated in a small electric boiler with thermostatic control maintaining the temperature at plus or minus 2.5°C. from the pre-determined level ranging from 13° to 18°C. Questionnaires were placed on the seats, and on these forms the occupants were invited to record their impressions as to the degree of comfort experienced. The general impression was that with floor temperatures ranging from 28°C. when the air was at 13°C. to 39°C. with the air at 59°C., satisfactory conditions were obtained. In this range a constant temperature of the feet of 18°C. was obtained with waist temperatures from 16° to 12.5°C. and at the head 15.5° to 11°C. respectively, running practically in a straight line relation. M. Missenard estimates that the cost of treating and running the whole floor area of the nave in this case would be 10 times as much as by attempting to heat the air in the orthodox manner. Nevertheless, the method seems to be particularly well suited to the heating of churches but it is also applicable to large works or factory bays, even to open air sites where people assemble in localized areas. In works or factories it could be combined with overhead heating to minimize the difference between feet and head temperatures. A useful piece of data obtained in the preliminary investigations is the relation between floor temperature and temperature of the feet with different footwear. Where T is the ambient air temperature and t the floor temperature, the resultant temperature of the feet (° centigrade) is 0.62T + 0.38t for thin leather soles to 0.7T + 0.32t for crepe soles about 1 cm. thick. Orthodox opinion is that the floor temperature should not exceed 28° in heating by radiation, but M. Missenard does not accept this limitation since all his tests have shown that the resultant temperature of the feet is the sole criterion of the sensation of warmth. Both are related to the air temperature. American standards are a little lower, but he found that with air at 5°C. and the floor at 40°C. the resultant foot temperature is only 18°C.

BRITISH STANDARDS

THE twelve months under review, in the recently published annual report of British Standards Institution, saw some significant changes of emphasis in the scope and direction of the Institution's technical and administrative services to industry. Considering first the new and revised standards issued, the figures show for the first time in some years a slight decrease compared with the preceding year. The 1954-1955 totals were; 197 new standards and 73 revised standards, against 198 and 88 respectively for 1953-1954. However, these figures are not the only record of the usefulness of the B.S.I. Co-ordinating the current standards and keeping up-to-date the standards in operation play an important part. This is shown by the total of 228 amendments to existing standards issued last year, compared with 174 in the previous year. The main theme of the report is the ever-increasing activity of the B.S.I. The year 1954-1955 has seen a marked increase in the number of meetings of committees, sub-committees and working groups of I.S.O. and I.E.C. Two new Councils have been set up. A section of the Divisional Reports is now devoted to the work of the Council for Codes of Practice, which was constituted early in the year 1954-1955. The four Codes of Practice Committees, for Buildings, Civil Engineering, Electrical Engineering and Mechanical Engineering have been established and their work detailed. An Advisory Council on Standards for Consumer Goods provides information on the needs of domestic consumers to standards for the goods they buy.

The co-ordination of standards is always a necessary task—not only to avoid inconsistency or overlapping but also to see that the standards provide the most economic range to suit different end-uses. A special committee is being set up to co-ordinate standards of common interest to the chemical engineering, mechanical engineering and petroleum equipment industries. The largest section of the report deals with the projects for British Standards which have been under consideration during the year by some sixty major industries. Notes on the more important standards issued during the year, and on significant developments on other projects, are also included in this section. Naturally only a selection of the projects in hand at any time can be described in the report as the number of these totals many thousands. The final section enumerates the work of three international organizations, the International Organization for Standardization (I.S.O.), the International Electrotechnical Commission (I.E.C.) and the International Commission on Rules for the Approval of Electrical Equipment (C.E.E.) and briefly records the subjects under discussion and the progress made in the Technical Committee concerned. A page of statistics included in the 'General Report' indicates once again the rising scale of the B.S.I. work, just under 900,000

copies of standards sold in the year, over 4,000 meetings of committees held, 1,300 licences to use the B.S. Certification Marks issued. The subscribers come from commercial firms, trade associations, and professional bodies and now total 8,300. The accounts for the year show a small surplus of income over expenditure, these also being at a higher level than in the preceding period. Industry subscriptions reached the figure of £122,000 and sale of publications £101,000. The main increases in expenditure are due to: (1) International work, reflecting the increased scale of activity and number of meetings held abroad; (2) staff salaries, which have risen both as the result of the higher cost of living and the expansion of the technical staff; (3) certification marking, attributable to the growth of mark schemes. The Report deals with many new fields of work, the chief among these being atomic energy, road safety, and air pollution. We are pleased to note that as a result of recommendations made by the Beaver Committee, three new committees are working on various aspects of standardization related to the 'smog' problem. One of these is concerned with standard instruments for indicating and recording smoke density in flues, including a mechanism to sound an alarm when smoke emission exceeds a certain level; another is dealing with standard instruments for assessing grit concentrations in stack gases; and the third is examining the practice of smoke control in plants using various types of boilers and furnaces, with a view to the issue of recommendations on the level of smoke which is reasonable, given that the plant is operated efficiently. These three committees, we believe, are doing work of contemporary national importance, that is worthy of greater publicity.

THE YOUNGER GENERATION

THERE has been considerable discussion in recent years about the problems of old age and an ever-increasing aged population. But, side by side with this is the problem of the youth of today, whose difficulties are certainly no less, but which receive rather less attention and publicity. It is vital for the economy of this country that it utilizes one of its most valuable resources—its young people, in whom a great deal of time and money has been invested—to the best possible advantage. It is important, too, that they should be carefully educated and employed at the outset of their careers, to avoid under or over-employment in any one trade, industry or profession. It is estimated that owing to the sudden increase in the birth-rate after the Second World War in 1945, there will from 1956 onwards be an increasing number of persons attaining the age of fifteen. This increase will create many problems, particularly that of lack of schools and facilities for the use of leisure time and recreation. In 1952 it was realized by many people that the time had come for a board survey of the influences affecting boys and girls growing up in Britain today. King George's Jubilee Trust, which had been set up in 1935 to further the physical, mental and social welfare of the younger generation, offered its services to co-ordinate a survey. The result of this survey is now published by Odham's Limited, on behalf of the Council of the Trust. Entitled *Citizens of Tomorrow*, it carries as a sub-title 'A Study of Influences Affecting the Upbringing of Young People.' It was agreed that as there was already extant a mass of relevant information, much of which was quite recent but had never been properly collated, no original research would be undertaken for the survey. It was felt that the immediate need was to assess the work being done for young people and the needs which remained to be met. In order to deal with the matter accurately, the Study was broken down into four phases: The period of full-time attendance at school; the period after leaving school—influences of employment; influences of leisure; and the period in the Services. Each of these phases was under the special attention of a separate working party.

The most interesting of the reports which constitute the Survey comes from working party 'B,' which dealt with the influences of employment after leaving school. The Chairman of this working party was Sir Harold West, Vice-Chairman and Managing Director of Newton Chambers, Ltd. The party had many interesting observations to make. In particular there was the influence which arises from the differing ratios of young people to adults. This, the working party felt, might affect the relative influence of adults and the society of colleagues of the same age. The proportion of boys under 20 varies from 12% in the wood and cork industries to 2% in public administration and defence. The proportion is very low, only 4%, in the continuous process industries such as the gas industry. Apart from the leather and fur industries, the gas industry is also shown to have the lowest intake of 15 to 17 year-olds, and this is a matter which would bear careful consideration. Of course, few of the recommendations made by the working parties are new, but they are collated in this 142-page publication in an easily assimilated form. It is to be hoped that this report will be read not only by parents, but also by those who have the power to implement the recommendations, for upon the right handling of the rising generation may well depend our economic survival.

CHEMICAL HAZARDS

WE would recommend all gasworks chemists to read the booklet, *Safety Measures in Chemical Laboratories*, published by H.M.S.O. on behalf of the Department of Scientific and Industrial Research. The booklet has been compiled primarily for the guidance of new entrants to the Chemical Research Laboratory, but its contents are worthy of note by any laboratory worker, even the most experienced. It should be noted, however, that the booklet is not intended as a final document and no pretence is made that all causes of chemical hazards have been covered. Only those which have proved most prolific of personal injury and material damage have been included. Although the notes were prepared for the guidance of newcomers to the particular laboratory already mentioned, a considerable responsibility for the avoidance of accidents must concern the senior members of any laboratory and affect their supervision of junior staff. It is because of this that the booklet has been published. There are sections and recommendations that deal with general laboratory operations, fire risks and burns, electrical hazards and shock, dermatitis, poisons, poison gases, and the treatment of affected persons. One of the two appendices outlines a scheme for general safety organization, and the other details a suggested standard form to be used for the reporting of accidents.

Any newcomer to a large laboratory will probably observe an apparent casualness in the older workers. But, we are warned, this is one of the things that a newcomer should try not to imitate too soon. The older workers take precautions that may not be immediately obvious; carefulness is a point that is emphasized throughout the booklet. It is shown that where chemical reactions may have been carried out carelessly with small quantities of material in a school or college laboratory, the hazards are much greater in an industrial laboratory when the quantities are appreciably increased. Warnings concerning too much haste, treatment of apparatus and materials, and interruption of work, cannot be too often repeated. As most of the more dangerous materials and conditions are to be met by research and works' chemists in the gas industry, this is a most appropriate publication for them to study.

Personal Notes

MR. C. H. LEACH, M.A., General Manager of the Liverpool Group of the North Western Gas Board, has been appointed by the Minister of Fuel and Power as Chairman of the Southern Gas Board in succession to MR. A. R. MCBAIN. Mr. Leach began his career in the gas industry as Secretary with the Alliance and Dublin Consumers Gas Company. He was then appointed General Manager of the former Liverpool Gas Company. Mr. Leach, who is a Fellow of the Association of Incorporated Statisticians and a Member of the Institute of Chartered Accountants, is extremely well known in the gas industry, and his controversial paper 'Functionalism as a Tool of Management,' which he presented to the Institution of Gas Engineers in 1948 will be well remembered. He was awarded a half blue for lacrosse at Oxford and is interested in miniature photography and shooting. He takes up his new post on January 1, on the expiry of Mr. McBain's term of office.

MR. G. W. THOMAS, formerly Works Superintendent of the Rushden Undertaking of the East Midlands Gas Board, has left the industry after 30 years' service. Mr. Thomas, whose family has been connected with the gas industry for four generations, was a pupil of the Northampton Gaslight Co., Ltd., in 1925, and went to the Rushden & District Gas Co. as assistant engineer in 1946.

MR. F. C. SMITH, M.B.E., Secretary to the Watson House Centre, leaves the employ of the North Thames Gas Board at the end of the year after 50 years' service in the gas industry. It is pleasing, however, to report that Mr. Smith's services will not be lost to the Industry as he is accepting a position as consultant to the Gas Council from January 1, 1956, on matters relating to the safe use of gas, regarding which he possesses a unique knowledge. Mr. Smith started his career in 1905 in the Mains Department of the old Gas Light and Coke

Company, being transferred shortly after to the Stove and Meter Department and subsequently to the Gas Sales Department to serve under Sir Francis Goodenough. After obtaining a number of scientific qualifications Mr. Smith became Assistant to Mr. J. G. Clark in his work on problems relating to the utilization of gas. When the Watson House Laboratories were established at Nine Elms as the research and development centre for the Gas Light and Coke Company in matters concerning gas utilization, Mr. Smith joined them and saw their growth to the national status they enjoy today. Of late years he has been specially associated with the Watson House Centre as Joint Secretary and finally Secretary. Mr. Smith was associated with the Westminster Technical College where he taught students taking the advanced courses in the Educational Scheme of the Institution of Gas Engineers of which Mr. Smith is a Member. He is a Fellow of the Chemical Society, the Physical Society and the Illuminating Engineering Society. He has also been a President of the Junior Gas Association, and is the author of many technical papers and has on two occasions won the Bronze Medal of the Institution of Gas Engineers.

MR. RICHARD JONES has been appointed Grid Manager (South Wales) by the Wales Gas Board in succession to MR. T. S. RICKETTS. Mr. Jones was born in 1914 and was educated at St. Asaph Grammar School and at the Wrexham and Liverpool Technical Colleges. Mr. Jones was a founder member and also the first Chairman of the North Wales Branch of the Wales and Monmouthshire Junior Gas Association and was President of the Association in 1953/54. His interests include golf, tennis and rough-shooting. Mr. Jones commenced his new duties on October 31.

Obituary

MR. W. E. JEWELL, who had served Falk, Stadelmann and Co. Ltd., for nearly 53 years and later on became Manager of the Contracts Department, died in Brighton on October 29, aged 78. He retired from Falks in March, 1948. Mr. Jewell was a very popular man, an ardent freemason, and a keen golfer.

MRS. GOULD, wife of Lt.-Colonel J. A. Gould, M.C., Distributing Engineer of the South Eastern Gas Board and Chairman of the Pipes Committee of the Institution of Gas Engineers, died at Farnborough Hospital, Kent, on November 7, 1955, after a long illness.

MR. B. L. POTTER, Divisional Sales Manager of Elliott Brothers (London), Limited, died suddenly at the age of 56 at his Welling home on October 25, 1955. Mr. Potter joined the staff of Elliott Brothers in March, 1923.

MR HUGH CAMPBELL MCMAHON, has died. He was fifty-four years a member of the staff of the Bangor Borough Council Gas Department. Mr. McMahon was to have retired this month.

Diary

November 17. — EASTERN SECTION, I.G.E.: 'Coke and the Beaver Report,' C. A. Deas. 17, Grosvenor Crescent, London, S.W.1. 2.30 p.m.

November 23.—ROYAL SOCIETY OF ARTS: 'Research in Industry,' by B. K. Blount (E. Frankland Armstrong Memorial Lecture). Royal Society of Arts, John Adam Street, Adelphi, London, W.C.2. 2.30 p.m. Tickets available on application to Secretary.

November 25.—JUNIOR INSTITUTION OF ENGINEERS: Annual General Meeting. Pepys House, 14, Rochester Row, Westminster, London, S.W.1. 7 p.m.

November 24.—INSTITUTE OF FUEL: Joint meeting with National Smoke Abatement Society. 'Some Problems in Domestic Heating,' J. S. Hales. 9, The Temple, Dale Street, Liverpool. 7 p.m.

November 24.—INSTITUTE OF FUEL: 'Industrial Aspects of the Beaver Report,' G. Nonhebel. James Watt Institute, Great Charles Street, Birmingham. 6 p.m.

November 29.—LONDON AND SOUTHERN SECTION, I.G.E.: 'Ammonia Liquor as an Agricultural Fertilizer,' by H. M. Lawrence. Junior Institution, Pepys House, 14, Rochester Row, London, S.W.1. 2.30 p.m.

November 29.—INSTITUTION OF HEATING AND VENTILATING ENGINEERS: 'Is Automatic Firing Efficient?' A. G. Ludgater. Junior Institution, Pepys House, 14, Rochester Row, S.W.1. 6.30 p.m.

November 30.—MANCHESTER JUNIORS: Visit to W. C. Holmes and Co., Ltd., Huddersfield. Paper, 'Consideration of the Preparation of Coke for Sale.' V. E. Chancellor.

December 2. — INSTITUTE OF FUEL: 'Wales Gas Board—Integration of Fuel Supplies,' E. M. Edwards, W. T. Hird, T. S. Ricketts, S. L. Wright. South Wales Institute of Engineers, Park Place, Cardiff. 6 p.m.

December 3. — WALES AND MON. JUNIORS (WESTERN): Visit to Robert Dempster and Company. Paper, 'Recent Developments in Purification Technique,' E. Aspinall. Bath.

December 3.—SCOTTISH JUNIORS (EASTERN): Joint Meeting with the Western District. 'Integration in the Manchester Group of the North Western Gas Board.' L. S. Crowle. Heriot-Watt College, Edinburgh. 3 p.m.

December 6.—SOUTH EASTERN G.C.C.: Caxton Hall, Westminster, London. S.W.1. 10.45 a.m. Consultative Council and District Committees. Alliance Hall, Caxton Street, Westminster, London, S.W.1. 2.30 p.m.

December 7.—INSTITUTE OF FUEL: Melchett Lecture for 1955: 'Power Population and Productivity,' Dr. A. Parker. Institution of Civil Engineers George Street, London, S.W.1. 5.30 p.m.

Refractories for Gas Retorts*

By H. Oliver, B.Sc., F.R.I.C., F.Inst.Ceram. † and
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In carbonizing operations there are certain essential demands upon the refractories used as the constructional material. These materials must be refractory at their working temperatures and have other suitable thermal properties. The whole structure also must retain its mechanical stability and give an efficient service life.

The durability of the structures used in the carbonizing of coal is dependent upon three general factors. First, it is dependent upon the techniques of the operations, such as the careful control of temperatures, attention to pressures at various levels within the retort, and regular inspection of retorts. The labour factor can materially influence the operational conditions. They can accelerate the rate of deterioration of the refractories by causing uneven heating, irregular charging, bad rodding technique, careless resealing of coke doors and other inefficient actions. Second, the properties of the coal have considerable influences on refractory life. The full influence of the properties of coal itself upon the life of retort refractories is not yet clearly understood, and it must be remembered that a wide variety of coals are carbonized in the industry. Third, owing to the variation in conditions, which operate at different levels in the retorts, the demands upon the refractory materials must be different at each level.

Of all the general causes of deterioration in a retort setting, such as mechanical failure and chemical attack, perhaps the greatest influencing factor is temperature. With higher working temperatures the chemical action between slag and refractory will be increased, assuming the reaction rate follows the general exponential rate formula. Fluctuations in temperature, particularly over the critical range of temperature for silica materials of 100° to 600°C. will cause strains in the refractory materials leading ultimately to cracking and spalling.

Manufacture of Refractory Materials

Standard specifications are laid down by the gas industry as to the general composition and physical properties necessary for the refractory materials used in the industry. They give a valuable guide to the manufacturer as to the quality to be attained by his products.

The manufacturer has two methods of approach with respect to the attainment of a high quality product. He can:—

(a) Win local materials, such as fireclays, sands and ganisters, then process them to develop the best products allowed by the limitations of the raw materials.

(b) Win or purchase raw materials which, after careful treatment, can be processed to give refractory products with properties satisfying known operational conditions.

The former method is generally applied to normal fireclay products, standard siliceous sand and clay materials, and the bulk production of silica refractories. The latter method is general for special high alumina firebricks, blended siliceous products and special low-porosity silica refractories.

(*a*) *Fireclay Refractories.*

The majority of refractory fireclays are found in the coal measures of the Carboniferous series. A fireclay consists mainly of a kaolinite type clay mineral which has been formed initially by the weathering and distintegration of certain igneous rocks. It has, however, undergone considerable change due to transportation and sedimentation and, in consequence, has become associated with a number of accessory minerals. These are chiefly quartz, micas, felspars, ferruginous and calcareous materials and carbonaceous matter. These minerals can vary considerably in amount, and profoundly affect the properties of the fireclays in both the raw and the fired state.

The processes involved in the manufacture of fireclay products generally follow the pattern of manufacture outlined previously. One important variation is in the amount of prefired fireclay material, 'grog,' added during the mixing stage. The amount used is dependent upon the nature of the raw clay, and is primarily added in a graded form to reduce drying and firing shrinkage. Grog also has a considerable influence on the texture of the finished product.

The use of modern mixing and milling methods for the production of firebrick standards is now established as providing products of greater uniformity and superior quality. The shaping of the clay mixtures can be carried out in various ways, for example by 'dry' pressing or by shaping material in a plastic state. Lamination faults have to be avoided during shaping. The drying is carried out on hot floors or in tunnel or chamber dryers, and care has to be taken to minimize the strain effects of drying shrinkage.

It is in the firing operation where the properties of the product are finally fixed. The first stage of the schedule, heating up to 250°C., ensures the removal of hygroscopic and colloid-held water. Then follows the oxidation period, up to approximately 850°C. where care is essential to prevent the formation of black-cored products resulting from incomplete oxidation of carbonaceous matter. The final vitrification period, up to the ultimate firing temperature is that where fluxing action and subsequent cohesion of the product takes place.

(*b*) *Siliceous Refractories.*

This class of products may be made from synthetic mixtures of fireclay and ground silica rock, but retort refractories are chiefly manufactured from siliceous sands. The sands are found in 'pockets' in the Carboniferous limestone of Derbyshire, and consist of varying proportions of silica sand, quartzite pebbles and clay with a wide range of particle size distribution. The silica contents of the materials range between 70 to 96%. The chief points in the manufacturing process are the care in selection of the raw materials and the controlled blending of the sands to ensure products of consistent properties.

The raw materials are won from open pits and classified mainly on the basis of their grain size distribution and silica content. The sands are then blended by proportional feeders to produce mixtures forming the basis for products with differing properties. Some preliminary drying of sands is necessary to enable the final moisture content of the mixture to be obtained by a subsequent controlled addition of water. After grinding and screening, the material is divided into small batches of approximately one ton weight by methods which ensure that each small batch is a uniform proportion, representative of the whole controlled batch.

At this point control tests on samples taken automatically during batching have shown the amount of clay and water necessary to give the desired composition and workability to the material. Thus, these preliminary operations give an accurate control of composition, grading and moisture content of the prepared material before shaping, and ensure a high degree of uniformity of composition and texture of the finished product. The shaping can be carried out either by semi-dry pressing at a high pressure, or by a semi-plastic method for certain shapes.

This method of manufacture is an illustration of the large amount of control necessary in the production of uniform products which have to satisfy close specifications. The method also provides the necessary flexibility with respect to the controlled variation of composition and consistency. In this way it has contributed to the development of a highly siliceous

* From a paper presented to the Autumn Meeting of the Midland Section I.Gas E. at Buxton on October 14.

† Derbyshire Silica Firebrick Co., Ltd.

(92% SiO_2) vertical retort material of increased bulk density and lower porosity and permeability. Special pressing techniques, such as percussion with sustained pressure, have been applied to the manufacture and are continuing to be developed to produce maximum fired density.

(c) Silica Refractories.

Though silica rocks are very widespread in Nature, the occurrence of raw materials suitable for the manufacture of silica bricks is fairly restricted. These raw materials embrace a large number of sedimentary rocks, the principal ones used being rock quartzites and ganisters with a high content of the essential constituent, mineral quartz. In the rocks, the quartz is consolidated in a siliceous matrix to form a hard, strongly bonded mass. The alumina content of the suitable raw materials must be very low, generally less than 1½%, because its presence reduces the refractoriness of the silica material.

The selected raw material is first washed to remove adhering clay impurities, then is subjected to the preliminaries of crushing, grinding and grading. A controlled amount of hydrated lime, calculated to give generally between 2 to 2.5% CaO is added, together with an air-setting bonding agent, cellulose sulphite lye. At this stage care must be taken to ensure that the ground material has the correct grading to give the product the required texture. Squares and shapes may be formed by handmoulding, pressing or pneumatic tamping.

(d) Other Refractory Materials.

Sillimanite Refractories. There are a number of naturally-occurring minerals with the general composition $Al_2O_3.SiO_2$, giving an alumina content approaching 65%. These minerals are sillimanite, andalusite and kyanite. All these minerals are dissociated at temperatures greater than 1,550°C. to form mullite, $3Al_2O_3.2SiO_2$, and cristobalite. Kyanite suffers considerable expansion on heating up to 1,500°C. and consequently must be precalcined before being used for refractory shapes.

The sequence of manufacture follows the general form. The mineral is crushed, ground, graded, bonded with a small amount of high grade clay, shaped, dried and fired at a temperature high enough to ensure that an adequate degree of bonding and decomposition to mullite and cristobalite has been achieved.

High Alumina Refractories. The raw materials for these products vary considerably in composition, and are mixtures of bauxite, gibbsite and diaspore with kaolinite. The mixtures can vary in composition from nearly pure hydrated alumina to almost all kaolinite. The raw material requires a high temperature of pre-calcination before incorporation in the brick mixture to reduce the subsequent firing shrinkage and to assist the conversion of corundum.

Properties of Refractory Materials

It is not intended to consider the methods of testing refractory materials used to assess their many properties. These can be found in B.S. 1902:1952. Rather, it is proposed to compare the properties of the main refractories used in the gas industry to illustrate their purpose in retort structure.

Refractoriness (Squatting Test).

Since the essential property of a refractory material is its capability of withstanding high temperatures without deformation, knowledge of the softening point is desirable. In this test, a cone of the material is heated at a defined temperature rate until squatting of the cone occurs and is then compared with standard Seger cones of known softening point.

Refractoriness under Load.

The information derived from this test is of more value than that from the refractoriness test since it approaches more closely to the conditions of industrial usage. A standard size specimen is subjected to an applied load and is heated at a controlled rate of temperature rise until an arbitrary failing point has been reached. The results are generally interpreted graphically, and the temperatures of first-sign of subsidence and of 10% subsidence are noted.

The value of this test can be enhanced by the addition of a time factor, and information can be derived as to the probable trends in behaviour of a material during the time of service. Comparative indications of tendency for after growth of contraction of materials when they are subject to load and time can be obtained. The choice of temperature of testing will be of vital importance when the information obtained is required to be related to carbonizing conditions. As yet, this is not scheduled as a standard test in the gas industry specifications.

Bulk Density, Porosity, Specific Gravity and Permeability.

With the exception of specific gravity, these properties are closely related to the textural qualities of a material. The specific gravity of a refractory material is of special worth in showing the completeness of conversion of quartz in 95% silica refractories, where the aim is towards a specific gravity of 2.32.

All these three properties are inter-related through the formula: $p = (1 - \frac{Sa}{St}) \times 100$ where p = true porosity, Sa = bulk density, St = specific gravity.

The permeability of a refractory material is a property of obvious practical value, and is measured by the rate of air flow through a specimen of known size at a known pressure. It is not directly related to the percentage porosity of a material, but is governed rather by the dimensions and shape of the pore spaces.

Much has been said about the value of having high density, low porosity and low permeability in silica and siliceous materials, and comparisons have been made between bricks made from South African silica, French silica and British silica raw materials. The two former materials have considerably lower permeability and porosity than the British silica materials, and it has been deduced that they showed greater resistance to flaking on this account. There are indications that these properties may change with temperature, and that their influence on durability may not be as previously imagined.

Permanent Linear Change on Reheating.

After-expansion of silica and siliceous materials is due to conversion of residual quartz to its lower specific gravity forms, and the conversion process continues to completion on repeated heating. As previously stated for 95% silica refractories, the aim in the manufacture is to complete the conversion reaction during firing, and so eliminate the subsequent volume change. With siliceous materials the object is to fire to that state which produces the most desirable properties for retort service. The permanent linear change occurring with siliceous materials is generally not very great because the expansion changes tend to be accommodated in the glassy matrix. With fireclays, a contraction is generally observed as reactions proceed further to completion, and this contraction on reheating can be restricted by use of the correct firing technique during manufacture.

Thermal Properties.

Reversible Thermal Expansion. The determination of expansion characteristics, together with the values from the refractoriness under load test, are of importance in the design of high temperature structures. The curves in Fig. 1 are

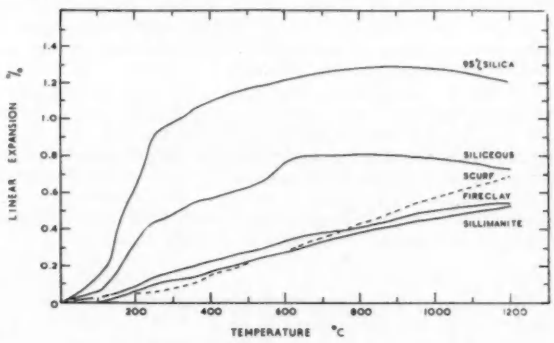

Fig. 1. Thermal expansion curves.

results of tests carried out in the laboratories to which the authors are attached. The curves show the necessity of careful, controlled heating of a silica or siliceous structure up to approximately 600°C.

Thermal Conductivity and Diffusivity. Thermal conductivity data is more useful in the consideration of mere heat transmission than in calculations requiring a knowledge of brick face temperatures. Thermal conductivity data is required

for the calculation of the thermal diffusivity of a material, as the two are interelated directly by: $K=\frac{k}{cs}$ *i.e.*, thermal diffusivity = thermal conductivity/heat capacity per unit volume.

Thermal diffusivity is the property which controls the propagation of temperature through a material. This value is required to be as high as possible for carbonizing refractories in order to obtain the required temperature on the working face of the retort wall. Diffusivity is to some extent related to the texture of a material, and is generally greater for silica refractories than for fireclay.

Slag Resistance.

A comprehensive assessment of the deleterious action of slags upon refractory materials requires a consideration of the complex reactions that can occur in solid, liquid and vapour phases between slag-forming substances and refractory materials over a wide range of temperature. Slag-forming substances include alkalis, basic oxides, iron oxides and a wide variety of complex silicates. In retorts, for example, iron compounds and alkali can be released from the coal charge and, depending upon the temperature and atmosphere, can intensively attack the refractory material.

Along with the such factors as the nature of the chemical reaction and the physical properties of the slag, the texture of the refractory material has considerable influence on the slag attack. With materials of high permeability, slags can travel into the refractory brick structure to a large extent and cause severe attack and failure. It is, therefore, advantageous to have a material of high bulk density and low permeability in a setting position susceptible to slag attack.

The measurement of the slag resistance of refractory materials has presented great difficulty in the preparation of standard test conditions owing to the variation in operating conditions and the complexity of the reactions. The main test, which allows a reasonable degree of standardization, is that in which a pill of compressed slag of known composition and weight is heated upon a refractory brick face to a definite temperature for a known period and an assessment of attack made on cooling.

Thermal Shock Resistance

Spalling of a refractory material is the failure of the material by disruption due to stresses imposed by temperature fluctuations. Several tests have been proposed involving heating and cooling cycles, both on individual specimens and on the face of brickwork panels, but the tests can only be considered as a guide to the behaviour of the materials under fluctuations of temperature.

With silica materials the thermal shock resistance is not high, particularly over the range of the inversion temperatures where obvious strains are imposed on the structure of the material. Plastic-made siliceous materials show more resistance than 95% silica, and semi-dry pressed siliceous materials have relatively high spalling resistance. For other materials, such as fireclay refractories where there is a glassy matrix, the stress-strain behaviour of the matrix, to a considerable degree, conditions the spalling tendency.

Jointing Cements

In service, a number of failures in refractory constructions could be attributed to imperfect sealing of joints. In consequence, it is desired that the joints should be thin, and should bond sufficiently strongly to remain gas-tight under operating conditions. Among other considerations for jointing cements, it is important that they do not react chemically with the refractory brickwork, and that they have similar expansion or contraction properties as the refractory material.

The value of the 'workability' of a cement is of obvious significance, for it must be capable of smooth application, yet form thin, strong joints. It has a marked effect on the soundness of the structure, and the importance of good workmanship during construction cannot be stressed too highly. It is advisable that all jointing materials should be wet-milled on site immediately prior to use to develop maximum workability.

Knowledge of the drying and firing properties of jointing materials are essential. The drying shrinkage and volume change on heating must approximate to the changes occurring in the refractory brickwork, and it is considered advantageous to have, if possible, a slight expansion on heating because undue contraction would lead directly to leakage.

In view of the importance of sound jointing to the efficiency of the plant, further research work is required to explain why it is that some joint brick surfaces remain sound while others laid with similar care with apparently identical materials lead to leaks. It seems that a technique is required to study the mechanism of surface adhesion in order to ensure 100% reliability for each refractory surface-cement junction.

BEHAVIOUR OF REFRACTORIES IN RETORT SETTINGS

Vertical Retorts

General.

Over the past twenty-five years the continuous vertical retort has become the main carbonizing unit of the gas industry, and although settings may differ in design, the principle of the operation is the same.

In general, the objective has been to increase the duration of operation before inspection and repair. So far as shape and size of retorts is concerned, design may be influenced to some degree by liaison between manufacturer and designer with respect to the shape and thickness of individual blocks in an attempt to minimize the risk of producing blocks affected by process strains which might be relieved by cracks or other faults in service.

Deterioration of Refractory Retort Materials in Service.

Zone 1. The material concerned is that from the top of the retort to about 5 ft. down, and mainly consists of fireclay shapes. The upper portion is generally affected by disintegration, either due to carbon penetration and subsequent burning out, or due to injury caused by poking rods striking the refractories. A hard dense firebrick is most suitable for this position.

Zone 2. 'Flaking' is the name given to the peculiar disruption of the working face of the retort material over a zone covering the area from 6 ft. to 12 ft. measured from the top. It is characterized by the removal of successive pieces from the surface of the retort. The flakes can vary from thin wafers about $\frac{1}{16}$ in. thick to slabs having a maximum thickness of 1 in. The latter phenomenon is of infrequent occurrence.

It is significant that the flaking area coincides approximately with the area of retort surface upon which hard carbon, commonly called 'scurf,' is deposited during the period of gas-making. Flaking appears to be bound up with the operation of 'scurfing.' For nearly twenty-five years investigations have been made to elucidate the mechanism of deterioration by flaking, and the problem still remains to be solved. The following is a brief outline of some of the explanations given of the mechanism of flaking:—

(1) It was suggested that during 'scurfing' procedure the interface temperature of scurf and refractory material increased to the point where further conversion of quartz at the carbonizing surface of the retort material took place with differential expansion stresses developing until the surface material shelled away at a plane of greatest strain.

(2) A later explanation of the mechanism postulated the alteration of the properties of the brickwork surface by penetration and attack by alkali salts. A change in the thermal expansion characteristics of this surface layer results in the failure occurring when the temperature of the surface increases during the scurfing period.

(3) Following the above, evidence was found of the occurrence of the flaked material in which there had been no apparent chemical attack. It was then postulated that the cause of such flaking would be mainly physical. Recent research work has shown that flaking can occur due to the deposition of carbon within the pores of the brickwork at temperatures fluctuating between 800°C. and 1,000°C. The explanation put forward is that strains are caused in the refractory due to the differential expansion of the carbon deposited and the refractory material, carbon having a coefficient of expansion of 6 to 7 $\times$ 10^{-6} over the range 800° to 1,000°C., while siliceous and silica refractories have negligible expansion movement over the same range.

(4) To explain the flaking of a carbonizing surface to a thickness of $\frac{1}{2}$ in. to 1 in. the following mechanism has

been suggested. The refractory material at the carbonizing surface has been penetrated by alkali salts, and during the period of deposition of scurf the alkalies diffuse to a distance where reaction with the matrix occurs. Then during scurfing the increase in temperature of the scurf during combustion causes a higher temperature wave to pass into the brick face until the plane of maximum alkali penetration is raised in temperature, thus increasing the fluidity of the alkali glass and reducing the mechanical strength until it fails to resist the shearing forces of the expanding scurf.

Of late years research on flaking mechanism at the British Ceramic Research Association has been concentrated upon studying scurf formation and on correlating the strains induced by the differential expansion of scurf deposited within the pores of the refractory and the refractory itself, over the 800° to 1,000°C. range of temperature fluctuation, with the occurrence of the weakened structure behind the brick surface in the flaking or scurfing zone; this being suggested as the physical explanation of the flaking phenomenon. On the basis of this the suggestion was made that aluminous firebricks or sillimanite materials having thermal expansion characteristics similar to that of scurf would greatly reduce the occurrence of flaking. Plant experiments are in progress to test the validity of this argument.

It is interesting to note that the thermal expansion of the sample of scurf recently tested by the authors, Fig. 1, has a coefficient of 10×10^{-6}, whereas Laming and Rigby quote the coefficient of carbon as 6 to 7×10^{-6}. The sample of scurf used was taken from a 95% silica retort setting, and the scurf had some portions of silica flake material attached to it in patches. Tests on the dense portion of scurf near to the refractory and on the more porous remaining portion gave total alkali contents of 0.38% Na_2O and 0.54 K_2O for the former, and 0.44 Na_2O and 0.78 K_2O for the latter. This indicates the tendency for alkalis to diffuse through the scurf to the refractory.

Flaking is generally not excessive with siliceous or straight silica retorts, but in some cases an increased rate of deterioration has been found when high alkali coals are carbonized. However, flaking is rarely the chief cause necessitating putting off retorts for repair, as the main deterioration occurs in the next zone.

Zone 3. Slag attack and erosion occurs in the area covered by the first 6 ft. above the bottom fireclay portion which is equal to the first three combustion chambers of a horizontally-heated vertical retort. The maximum temperature of the process is achieved in the charge at this position, and in this zone, too, the admission of steam, together with some possible air infiltration causes the liberation of some mineral ash from the charge. Oxides of iron, sodium and potassium are the more reactive slag-forming compounds which are normally found in retort slag products. It is noteworthy that a number of their compounds are relatively volatile and thus concentration of these elements may be found in certain zones.

In connection with the effect of iron oxide on silica materials, the question of the unsuitability of material containing iron spots is one of importance to the manufacturer in view of the necessity for conserving raw material by avoiding unnecessary rejection.

The fusible slags may be absorbed by the refractory material (if sufficiently high in silica) or provide a glaze-like coating with slight penetration in the case of siliceous material which is invaluable in causing gas tightness of the retort. In the latter case deterioration of the retort may sometimes occur in the lower zones by the removal of the glaze coating by the downward movement of the charge and the exposure of a fresh surface for further attack. Continual repetition of this cycle leads to ultimate thinning of the retort wall. This only occurs when bottom flue temperatures are higher than normal, or where air leakage has occurred sufficient to cause increased temperature within the retort with consequent increased fluidity of slag and more rapid rate of reaction. There is still controversy about the deleterious effects of air inleakage to the lower portions of retorts. A certain amount of air inleakage is not detrimental since air is admitted at regular intervals by the necessity for opening a door to discharge coke, but excessive air inleakage is undesirable. The amount of reaction naturally varies with the type of coal ash and the percentage ash content.

In zoned retorts, and all silica retorts, relatively little slag erosion occurs in the lower zones. This is due to the ability of 95% silica materials to absorb fluxing agents without losing mechanical stability. However, as the whole surface does not become slagged over as with siliceous materials the joints are subject to attack by fine dusts and vapours at one or more brick/joint junctions, and this leads eventually to holing and leakage.

Zone 4. This is the fireclay portion below the heated retort, and as the temperatures are not high it rarely shows marked deterioration. It has to withstand abrasion of the coke charge and to resist the action of any slag which runs down from the hotter zone above.

Leakage.

Leakage can occur at many portions of the retort structure. Its occurrence may be the result of factors unconnected with the quality of jointing material but due to faults such as poor joint making during construction, differential expansion movements or lack of control of heating rate during the initial heating up after repair. These are problems relating to construction, design and operation, and are not attributable to faulty refractory retort material. Jointing cement of unsuitable quality could have an obvious effect on the possibility of leakage. If inadequate cohesion occurs at the interface of brick and cement then leakage is likely to occur. Should the joint strength in low temperature fireclay portions be inadequately developed this, too, can lead to leakage.

Due to the formation of a monolithic glazed slag surface in the siliceous retort, completely covering bricks and joints, siliceous retorts have the much desired property of gas tightness, whereas all silica and zoned part silica retorts suffer leakage to a degree which often results in noticeable loss of therms and induces difficulties in control of heats. Leakage can be controlled, but if it is allowed to get out of hand the rate of deterioration of retorts is enhanced.

Vertical Retort Life

For horizontally heated vertical retorts the normal control temperatures are considered to be 1,300°C. to 1,320°C. for the lower combustion chambers, decreasing to about 1,000°C. for the top circulator. This caters for a throughput of the order of 5 tons per day with a 50 in. retort at a declared calorific value of 450 B.Th.U. per cu.ft. Under these conditions the guarantee of 1,000 days gasmaking before repair is a fair yardstick of satisfactory plant behaviour. The repair is then followed by another 1,000 days before reset. At the present time a repair cycle may occur between three and five years, but superimposed on this is the rota of plant repairs, the influence of which must be borne in mind.

Horizontal Retorts

Silica or clay-bonded siliceous materials are generally used for modern horizontal retorts. The 95% silica is sometimes used for the retorts' supporting walls and combustion chambers, but there are several large installations in which clay-bonded siliceous segmental retorts and supporting walls are incorporated with 95% combustion chamber linings. Very satisfactory results are claimed by the users of the siliceous segmental retorts by reason of maintenance of the gas tightness of the retorts throughout the operational life. The main cause of deterioration in horizontal retorts is slag attack with abrasion of the bottom as a contributory cause. Leakage sometimes occurs due probably to local movements in the retort which have been actuated by temperature changes or by stresses due to 'letting down' during periods of low demand. Lives of 2,000 to 3,000 days are now considered normal.

Research and Trends

Twenty-eight years ago the present Director of the British Ceramic Research Association wrote, 'Going hand-in-hand with the investigation of the fundamental properties, the definition of the actual conditions of usage is an essential.' Since then much valuable work has been done in both fields by the joint efforts of the gas industry and the Research Association. A better appreciation of the working conditions is gradually emerging from this work, also of the mechanism of certain zonal actions affecting the durability of the refractories. Given that the correct assessment is made with respect to the properties governing the resistance of the refractory material to the

particular conditions of usage, then the refractories capable of giving improved service under these conditions will ultimately be produced. Valuable service to the study of refractories durability has also been rendered by numerous plants in the past years by the regular recording of standard data relating to plant operation and life. The more widespread and full such recording of data becomes the more speedy will be the solution of the refractory problems. In the immediate future the target is to minimize flaking and eliminate leakage. In the more distant future new gasmaking processes may create new operating conditions for retort materials. The refractories industry will endeavour to meet the demands as the necessary data defining operating conditions are made available.

DISCUSSION

Mr. A. Allen, Chairman of the Section, opening the discussion, said it seemed that much had yet to be learned about the conduct of refractories in operation. What gas engineers were looking for was a refractory that would stand up to temperatures of working recommended by the makers of retorts, a design of retort that would give even temperatures and, in view of the different types of coal that had to be used, a refractory that would enable them to forget all about these different coals in so far as retort life was concerned.

Mr. E. T. Pickering said the paper reviewed knowledge and lack of knowledge of refractories in an admirable way. He emphasized the importance of design. There had been cases of designs where the retort behaved with a considerable degree of satisfaction in one material and yet when silica was used there was leakage. Silica was sometimes blamed for leakage when it was really a matter of retort design. Reference had been made to the importance of keeping records of the factors affecting the life of the retorts. There was likely to be a lack of knowledge of some factors; for instance, when the engineer came to investigate, he would not be able to give the analyses of coal ash of all the different coals received. Some guidance was wanted on what records should be kept. He did not think they would get to the bottom of refractory problems until they new the effect of different coals. They ought to investigate the technical side of the rational carbonization of selected coals. At one works in the West Midlands area research was being carried out with four different retorts of similar design, using different coals. But there was no particular means of segregating the coals. It would be well if they could take two types of retort from the standpoint of materials used and four different types of coal—one having low iron, calcium and alkali contents, one with low calcium and alkali and high iron contents and so on. At least three of each type of retort would be required and special arrangements made to maintain a supply of the required coals. Knowledge from such trials would indicate the best retort materials and carbonizing conditions to secure optimum results with given coals.

Mr. Oliver replied that problems of retort design were continually under review, in liaison between retort designers and refractories manufacturers, especially with respect to the limits of size and shape of refractory goods. Mr. Pickering's suggestion to investigate different coals was a good one and he would like to see it taken up. Concerning refractories that would stand up to any conditions he did not think there was any possibility of this in what might be termed normally available refractory materials. Constant improvements were taking place, but if materials were required to give satisfactory behaviour with all types of coal the cost of refractory materials would increase by a fantastic amount. He said his firm was going on with its work on the high density, low permeability, siliceous brick.

Mr. Allen said the point he would like to stress was that it would be much easier for everyone concerned with carbonization of coal if they had refractory materials to stand up to the ash from any of the coals used. He raised this point with a specific purpose, and he was glad Mr. Oliver had it in mind. If it was not possible to get a longer life of retorts with present materials, would they not have to think of something quite apart from silica or siliceous materials? Much was heard these days about heat-resisting iron and steel and he thought these materials should be considered.

Mr. T. F. E. Rhead said it was most encouraging to hear of such careful control being given to the selection, sizing and blending of raw materials and to their subsequent moulding and firing. All this cost money. As regards flaking he thought all the theories mentioned might contain some element of truth. Flaking was encouraged in processes such as extrusion, pressing, etc., which tended to produce laminated and flow textures. The life of a refractory depended also on care in building, in raising of heats, care in use and maintenance. One had to equate the economies of higher throughput at higher temperatures against the increased wastage of refractories caused by such temperatures.

Mr. Oliver, referring to Mr. Allen's allusion to heat-resisting iron, asked what would happen if it worked satisfactorily, say at 1,100°C. Immediately, engineers would want to advance it to 1,200°C. or 1,250°C. and higher heat-resistance would be demanded. Could they get it in iron or steel? Replying to Mr. Rhead, Mr. Oliver said flaking could be influenced by texture and this matter was constantly borne in mind. At their own works the risk of flaking due to lamination in extruded sections had been virtually eliminated.

Mr. F. H. Bate said that quite a small percentage of increased life of refractory materials would make a tremendous difference to the economics of gasmaking. He believed that a complete solution of all the problems would only arise from co-operation between laboratory work, research in the field, and contributions based on the observations of gas engineers during their ordinary working life. Operational factors in the retort house would escape the laboratory workers.

He had been impressed by the surprisingly long life of some retorts. These were often at works without much technical supervision and no hot repairs were carried out. At such works the temperatures were not excessive, they always carbonized good coal, steaming was kept low, and in two instances retorts were discharged at three-hourly intervals. He was surprised that more attention had not been directed towards the effects of chloride, which could attain quite high figures in some washed small coal. On one occasion it had been noted that the coal boxes on certain retorts were deteriorating rapidly. It was found that the moisture in this coal contained 700 grains of sodium chloride per gal. and the total chlorides were nearly 1,000 grains per gal. Investigation revealed a high concentration of chlorides in the water at the washer at the colliery. The retorts which had received this coal would have a working life of nearly four years, and but for the effects of the chloride attack he had no doubt they would have lasted for five years between resets.

Referring to scurfing, very little attention had been devoted to the conditions that obtained during coke discharge when there would be an admittance of air due to the chimney effect of the retort; this air could produce similar conditions to that obtained during scurfing. The air would ascend around the charge in the retort and there would be considerable 'heat racking' on the surface of the retort. These conditions occurred 12 times per day under normal practice. Should there be defective bottom castings or failure to close the bottom doors, this 'heat racking' would persist continuously. There was a very great difference between the behaviour of refractories in vertical retorts as compared with horizontals and coke ovens, and it was possible that the admittance of air through the bottom castings of vertical retorts whether by accident or by faulty working operations might explain some of these differences. The 'heat racking' above described would exceed that which occurred during scurfing.

The gas engineer was often silent during technical discussions on refractories. This was regrettable as he had important contributions to make which would escape the research worker with a purely theoretical approach.

Mr. S. K. Hawthorn said what was wanted was a retort setting that would live longer—and that did not revolve solely around refractories. Four factors were involved—design, materials, care in construction and operating conditions. Careless heating-up could cause the bricks to shuffle in all sorts of ways, unless their movements were restrained. Expansion spaces could be a source of trouble if, failing to close, they allowed the bricks to move relative to one another. Quite a lot of failures of retort settings were not due to refractories but to other matters. It was absolutely vital in the building of retorts that there should be first class workmanship, work carried out by inferior bricklayers did not stand the exacting test of service. Careful attention was needed to size of bricks, because if they were small the joints were bigger than they

(*Continued on page 464*)

6th INTERNATIONAL GAS CONFERENCE PAPER

Safety Regulations for Gasworks

AT the request of the International Gas Union the Netherlands Gas Association presented at New York a report on the safety regulations related to gasworks lay-out, construction and operation as practised in the several countries affiliated with the Union. A questionnaire under 15 main headings was issued to the gas industries of those countries, to which replies were received from 12 of them including most of the countries west of the 'Iron Curtain,' the United States of America and Japan. The Report takes the form of summaries of the replies under the several headings. 'Where some countries have given particular attention to special measures, so that these can be accepted as directional, they have been quoted rather fully.'

Question No. 1 related to what restrictive regulations there might be for the erection of buildings or industrial plants in the vicinity of gasworks, gasholders or compressor and/or governing stations. Great Britain (among other countries) reported that there were no special regulations in this respect. (We suggest, however, that the point is to some extent covered by the operations of the Town and Country Planning Act and, in the inverse sense, by the scheduling of land for gas manufacture.) Several countries prescribe a minimum distance to be kept clear of buildings around a gasholder; in Denmark, 'the minimum width of this strip must be equal to half the height of the holder.' The question is obviously becoming complicated by the growth in the use of propane and butane/air mixtures, the risks associated with which are receiving attention in France and other countries where these techniques are most highly developed.

Measures adopted against the dangers of fire and explosion were sub-divided under 17 sub-headings. The 'no-smoking' rule is adopted universally to an extent varying from the whole works to specified danger zones. Prescriptions for the ventilation of rooms where there is risk of explosion reach their climax in France, for security in propane or butane/air stations. Ventilation must have, 'the effect of renewing the air about four times an hour' and mechanical ventilation must be used when necessary. An interesting sentence is: 'As propane is a heavy gas, the openings at ground level must be placed in such a fashion that the total outflow of propane is possible, and that gas cannot flow towards lower points.' All countries use stringent precautions against lighting hazards.

Gas detector alarms are not greatly favoured; 'American gas companies place relatively little reliance on such devices,' The English reply to this question (if any) is not recorded. On the other hand very full replies were received to the question about danger from electric sparking. It would seem that practice is generally in line with our own Institution's Safety Rules. Allied questions related to the design and fixing of doors to 'explosion-risk' rooms, the maintenance and control of syphons and the tightness of bells of wet governors.

There is a variety of practice in the control of temperature of coal and coke storage heaps. 'Fairly generally, Fire Insurance Companies allow a maximum (depth) of 5 metres.' Control is not regarded as necessary in coke storage. In England 'whenever coal heaps are over 12 ft. in height, it is usual to have steel rods inserted in the heap and reaching the bottom. Rapid temperature rises are detected by feeling through conductivity of the rods.' In the Netherlands and other countries, pipes are often inserted (closed at the bottom to prevent circulation of air) and temperatures are observed regularly. In all countries stored coal is kept out of contact with timber. Generally coal stores are constructed with non-inflammable materials. The same rule applies to the storage and revivification of purification material.

The heating of works buildings and water-sealed gasholders were combined in one question. The English reply referred to the requirements of the Factories Acts and to the three Safety Recommendations issued by the Institution relating to the steps taken against frost in gasholders and other plants. Practice in other countries is not very different. Two sub-questions referred to personnel and appliances for dealing with fire. Replies described the latter in more or less detail down to the minimum represented by the U.S.A. reply: 'This subject is usually worked out in co-operation with the city fire department.' Personnel varies from a complete fire brigade to a team recruited from, 'the personnel of the continuous service.'

Two questions related to provisions for first-aid. Large works appear to have a number of the staff trained to render first-aid under the direction of a works doctor or at least a qualified male or female nurse. Small works mostly have at least one trained help, who in most countries is required by law. Another question asked was whether there was a specified person whose duty is the supervision of safety measures in the works. In large works in England there is usually a Safety Officer and the same applies to the U.S.A. The Swiss reply was: 'Yes, the Works Manager.'

'Special regulations for conveyor plants are not mentioned by any country. On the other hand safety measures are fairly generally quoted which are in general use for electrically-driven machines, both for safeguarding of the attendant personnel or for the surroundings and the conveyor plant itself.' Our own Safety Recommendations and Factories Acts make a good showing in comparison with practice elsewhere. The modern mechanical handling plants erected in this country are characterized by sequence starting and safety push-button controls which deal very fully with both these requirements.

Purifier operation is covered in six sub-questions. The Institution Code of Practice of 1950 is obviously regarded as a model. Several countries report special precautions against the ignition of oxide in the boxes and the control of drainage. The danger arising out of the latter in purifier installations at ground level is being dealt with by a revision of the Rules now under consideration by the Institution Supply Rules Committee and preliminary recommendations are cited. It is reported that in the Netherlands ground level boxes are seldom used and that the danger with elevated boxes is much less.

Two questions related to the marking of valves to show their position, open or shut, and to the systematic periodic testing and moving of valves to ensure that they are free to work. Generally, valves are adequately marked. Valves standing for any length of time are liable to become fast or difficult to move in an emergency and it is surprising that in very few countries are regular inspection and operation at prescribed intervals a part of routine. In England 'valves are regularly checked for ease of operation, but no set period of time is prescribed.' Only Japan reports that 'prescribed periodical inspection is performed.'

Practice with regard to the placing of a syphon between exhauster and purifiers varies considerably in the different countries. In England it is recommended in the Code of Practice. Precautionary measures to prevent men from falling into tar and liquor tanks are covered in England by the Factories Act, 1937; some such provision is enforced in most countries.

Regulations governing the erection and arrangement of propane and butane tanks particularly in relation to surrounding buildings, in considerable detail, are in force particularly in France with Governmental sanction. These are more or less general, except that in the U.S.A. this function is performed by the Insurance Companies.

Several countries have official regulations controlling the building and positioning of gasholders. In England, 'the only inhibiting regulations are those of the Town and Country Planning Authorities and these are not primarily concerned with safety.' Special measures to prevent the so-called 'blowing of wet, completely filled gasholders' are not generally prescribed. It is left to operators to see that production is slowed down in time before gasholders can begin to blow. In some countries automatic indicators, with or without alarms,

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ASH AND INORGANIC MATERIAL IN COAL

By A. R. Myhill, F.R.I.C., M.Inst.Gas E., M.Inst.F.

PROBLEMS relating to ash in coal are of very great complexity and bear on quantity and quality of coal, the economics of removing it at the source, the economics of utilizing high-ash coals or coals with ash of particular characteristics, the selection or design of plant for dealing with ash problems and a host of other considerations.

The necessity for investigations and scientific treatment of these matters has, of late years, become increasingly pressing on account of the general increase in the proportion of ash in the coals received by consumers. It is probably true to say that the overall percentage in ash content of coals used for gasmaking has increased by 1.5 to 2% calculated on total coal weight, in the last five years. This of course is directly reflected in gas yields per ton and in cost of transport of inert material. In other usages of coal, *e.g.*, steam raising, and furnace heating, the general increase in ash is likely to be considerably higher.

Coal production during the last war concerned itself more with quantity, than with quality, and large amounts of coal were obtained from sources hitherto considered too poor to work. The great increase in mechanized methods of coal cutting which followed nationalisation, with consequent lack of discrimination between coal and rock or clay at the fringes of the seam, has doubtless contributed in no small measure to the present excessive ash content. Added to this is the deterioration of coal-cleaning equipment at the collieries and the difficulty of replacement of this type of plant. The National Coal Board has this matter very much in mind and there is every likelihood that improvements in coal quality will eventually ensue. In the meantime, users of coal are still having to face many difficulties and expenses related to ash problems.

The amount and properties of ash are obviously related to the inorganic matter (usually termed 'mineral matter') of the coal, although of course, ash is not synonymous with mineral matter, the former being the residue left after burning, either directly, as when coal is burned under a boiler, or indirectly, when coal is carbonized and the coke residue burned or gasified. The composition of the ash will therefore be different from the original mineral matter and will vary in composition according to the treatment which the coal has received in the course of the formation of ash. Treatment which may influence ash composition includes processes of (a) chemical interaction of mineral constituents under the influence of heat, (b) oxidation, (c) reduction.

Ash-forming Impurities

Ash-forming impurities in coal may be either inherent or adventitious. Inherent mineral matter consists largely of the inorganic parts of the plants which produced the coal in prehistoric times. In the carboniferous vegetation, it existed mainly as salts dissolved in the sap of the trunks, branches and fronds. Such matter was, at some time or other, incorporated in the mud and slime of the true coal-forming substance and was later intimately incorporated with the 'banded' constituents of the coal. A certain proportion of the inherent matter, however, is derived from substances in solution in the water in which the coal substance has lain. Matter of this type, which in some cases may be present to the extent of 3% of the coal weight, but rarely exceeds about 4%, is revealed, as thin layers of about 0.01 to 0.02 in. thick, often white, yellow or reddish and is known as 'bind' or 'parting'.

Adventitious impurities constitute the major portion of the ash of coal. Such matter is not distributed homogeneously as is much of the inherent material but, being derived accidentally from rock, stone, slate, clay and other minerals, occurs in patches in, or adhering to, the true coal. Any of the normally-used types of coal-cleaning plant and processes will only remove the adventitious impurity. Since, however, the inherent impurity is very low, this treatment is all that is necessary for commercial cleaning.

The total ash content of coals used in industry varies as a rule from 3% to 20% calculated on the dry basis, although in some cases considerably higher percentages are recorded, especially for plant specially designed to consume such types. Several investigators have made comprehensive analyses of the mineral matter of coal. Foremost of these investigations are those carried out by C. G. Ball[1] who examined a complete section of a coal seam. He confirmed the observations of previous workers in finding detrital matter which had been laid down concurrently with the coal-forming plants, and secondary material which had been introduced after the deposition of the coal-forming material. He found that 95% of the mineral matter was made up of three minerals:

(a) *kaolinite* which is the basis of china clay and the refractory clays, present as fillings of vertical cracks and other interstices, and impregnating the fusain bands;

(b) *calcite*, a crystalline form of calcium carbonate, filling large cracks; and

(c) *pyrites*, a sulphide of iron occurring as yellow crystalline particles or flakes, often of considerable size, sometimes known as 'brasses' from their metallic appearance.

The remaining minerals included quartz, felspar, hornblende, muscovite, tourmaline, apatite and topaz. Some coals contain small quantities, varying from traces to, say, 1% of uncommon or rare metal compounds. Occasionally barium is found as sulphate or carbonate in certain coals mined in areas where seams of these materials cross or are interspersed with the seams of coal. This constituent was rarely determined in the older methods of ash analysis but later publications of standard methods provide for this, since some British coals contain considerable quantities.[2,3] Other elements occurring in traces are lead, zinc, cobalt, manganese and strontium. During carbonization, some of the more volatile constituents of these trace elements tend to concentrate in the tar, and in certain tar fractions and residues.[4] The presence of zinc and mercury in tars from certain coals has been reported.

Germanium is a rare metal occurring in the ash of certain coals and its discovery from this source has aroused considerable interest in recent years on account of the demand for this very scarce material for use in electronic appliances. It was first reported in coal ash by Goldschmidt[5] who detected it in German and English coals. Although this element is generally present in traces only, exceptional cases show as high as 1% in the coal ash. Such cases have been known to occur with special vitrain bands from Northumberland and Durham and are not representative of the whole seam. It is interesting to note that tests of the marginal stone and dirt on such seams show no appreciable germanium content. It is therefore concluded that germanium is derived from the inherent rather than the adventitious mineral matter. Since germanium salts are volatile, there is a great concentration effect of the element when coal or its ash is subjected to the effect of heat. Thus germanium is found in flue dust remote from the position at which the coal is burnt or gasified in percentages much greater than in the residual ash.

Composition of Coal Ash

Coal ashes vary greatly in composition, particularly in respect of relative proportions of the constituents. It has already been stated that the ash is generally of a different composition from the original mineral matter, since in the course of combustion or gasification, decompositions occur which result, in some cases, in the complete or near-complete disappearance of certain constituents from the residue. Thus, although the coal may contain up to 1% of chlorine as chlorides, this is often almost entirely vaporized during combustion, carrying with it its equivalent of alkali metals, iron and other substances. Coals

containing carbonates are decomposed by heat to give oxides with loss of CO_2. It is therefore found that the ash of a coal consists of a mixture of oxides, either in the form of oxide itself or as 'combined' oxides such as silicates, sulphates, or phosphates, where basic oxides have combined with acid oxides. The British Standard method of reporting the analysis of a coal ash[6] requires a quantitative statement of the proportions of the oxides given below:

Silica	SiO_2	Potassium Oxide	K_2O
Alumina	Al_2O_3	Titanium Oxide	TiO_2
Ferric Oxide	Fe_2O_3	Manganese Oxide	Mn_2O_4
Calcium Oxide	CaO	Sulphates as	SO_3
Magnesium Oxide	MgO	Phosphate as	P_2O_5
Sodium Oxide	Na_2O		

The components, calculated from determinations of the radicals, are expressed as equivalents of the oxides named above, although in some cases part of the iron and manganese may be present in the reduced form, as, for instance, ferrous or manganous silicates or magnetic iron oxide, Fe_3O_4.

The range of amounts of the main constitutents of British coal ashes is given by King and Crossley[7] as:

	%		%
SiO_2	25—50	MgO	0.5— 5
Al_2O_3	20—40	TiO_2	0— 3
Fe_2O_3	0—30	$K_2O + Na_2O$	1— 6
CaO	1—10	SO_3	1—12

Effects of Ash on the Industrial Uses of Coal

The properties of coal ash are manifested in the use of coal in the following industrial processes in particular:

(1) Carbonization in coke ovens.
(2) Carbonization in gas retorts.
(3) Gasification of coal or coke in producers or water gas plant.
(4) Use of coal or coke for steam generation.

The chief characteristics to be considered include:

Corrosive effects on refractories at high temperatures.
Contamination of manufactured products with undesirable constituents.
Clinkering troubles.
Deposits in flues.

In the process of coal carbonization, whether in coke ovens or gas retorts, deterioration of refractories is an all-too-common phenomenon. This deterioration is by no means confined to attack of firebrick or silica by coal ash. It is well known that other factors are of paramount importance. Such factors included mechanical stresses induced by temperature fluctuations, modifications in crystalline forms at certain temperatures, attack by gases, and other effects. There is no doubt, however, that attack by ash is an additional contributory factor in the disintegration of refractories. In a gas retort installation, attack on the walls due to fluxing may take place on both sides, *i.e.*, the flue side and the carbonizing side of the wall. There is a difference in these two cases. On the flue side, which might be expected to be more badly fluxed than the carbonizing side, we have first, higher temperatures and, second, more intimate contact of refractory with the fluxing agents of the ash. Dust carried forward from the producers which, in normal practice, are feeding the combustion flues with hot, uncleaned producer gas, travels along the whole length of the system as far as the chimney, being fractionally deposited in its passage according to the sizes and weights of the particles.

When this ash-dust reaches the combustion chambers, *i.e.*, at an early stage on its way through the setting, it contains many fine particles, some of which, at the prevailing temperature, are in a semi-fluid form and readily adhere to the brickwork, particularly in positions where there are abrupt changes in direction of flow, or where baffles exist, as, for example, at damper points. Chemical combination between the ash and the refractory takes place and slag attack results. The effect of chlorides in the fuel is important in this connection. Although the ash itself will probably be practically free from chlorides, these compounds, notably alkali and iron chlorides, will be present in the flues in gaseous form at the temperature of combustion and will fractionally condense in liquid and solid form at later positions in the system where the temperature is not so high. Such material, whether solid, liquid or gaseous, is highly corrosive to refractory brickwork and may have very deep penetration.

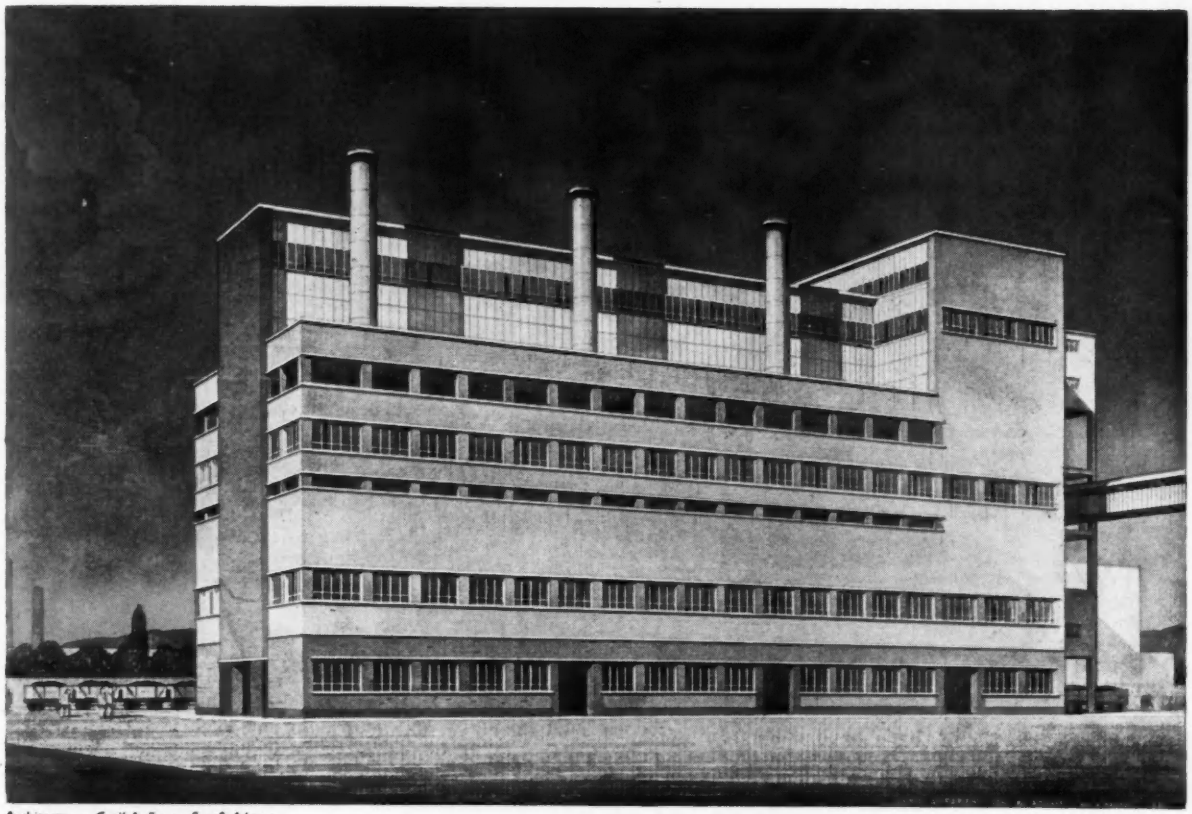
On the carbonizing side of the wall, however, attack from ash will not be so great, although other factors, including temperature variations, effect of carbon and hydrocarbons may be more severe. Since the coal and coke in the retort are not actually burned, as in producer practice or in the case of a furnace, large quantities of fine ash do not come into contact with the walls as happens on the flue side. When the volatile matter is driven off from the coal, the ash becomes concentrated in the coke and, even when steaming of the charge is practised, which liberates a certain amount of ash as the carbon of the coke is consumed, a large proportion is retained in the pores of the coke. Consequently, direct ash attack is not so heavy. Attack by chlorides takes place, however, but even so, this is lessened because temperatures on the carbonizing side of the wall are much lower than on the flue side and also because temperatures in the body of the charge are not sufficiently high to completely volatilize the chlorides, some of which remain in the coke.

It is an interesting fact that chloride attack in coke-oven operation is far less than in gas retort operation, particularly on the combustion-flue side of the wall. The reason for this is that coke-oven settings are fired with dust-free gas, this being either cleaned producer gas or coke-oven gas. Since coke-oven coke is used almost entirely for iron smelting and other metallurgical purposes, it is important that it should be as free as possible from any components which might contaminate the metal. Such undesirable constituents may be sulphur, phosphorus, arsenic, or silica, according to the process to which the metal or its ore is submitted. Many of these substances are obtainable from the ash of the coke, although others, notably sulphur, may be derived from the ash-free coal substance. Much of the sulphur in coke occurs in the ash, being derived from gypsum, pyrites and other minerals. Other things being equal, therefore, a low ash coal particularly free from excessive amounts of sulphur, phosphorus and arsenic, is most suited for coke-oven carbonization.

Formation of Clinker

The effects of ash in gas producer operation or water-gas manufacture, are principally related to clinker formation. The term 'clinker' is generally understood to mean masses of semi-fused material composed of melted ash, mixed with unburnt or partially burnt fuel. It may occur in any gasification processes where coal or coke is consumed through the agency of air, oxygen or steam. It may occur in any type of solid fuel furnace operation, such as in metallurgical work or, more especially, steam generation. Its presence in furnaces and gas generators is doubly disadvantageous, since it leads to thermal inefficiency, and because unburnt fuel is enclosed within it in such a form that air or steam cannot get into the mass which is clotted together by fused ash. The heating value of such fuel is therefore lost when the clinker is removed. Not only is such heat lost by reason of unburnt carbon but also a considerable waste takes place as sensible heat is removed as red hot fuel and material. Where producers, water gas generators or other furnaces are clinkered by hand, the presence of lumps of clinker renders the work very arduous and leads to irregularity of temperatures on account of the excessive length of time which is needed in keeping the clinkering doors open. For this reason mechanically-operated grates are of great advantage with high ash fuels or when using fuels liable to produce clinker. Even with mechanical grates, however (and much more so with static bar or step grates) large masses of clinker will lead to inefficient operation in the fuel bed due to irregular combustion or gasification, since a heterogeneous fuel bed contains 'rat-holes' or localized channels through which air, steam and gases can pass too freely, causing local hot or cool spots. Harmful effects of this kind are frequently encountered in step-grate producers used for heating retort settings.

Clinker is formed primarily by ash fusion. The liability to form clinker depends mainly on the ash fusion temperature, and, in general, clinker troubles may be expected when the fusion temperature is low, and the proportion of ash in the fuel is high. The matter is really more complicated than this simple statement would imply. The exceptional case where it may not be so, is where a furnace is specially constructed to operate at such a high temperature that the ash is completely molten, as, for example, in a blast furnace from which the fused ash can be tapped off with the molten slag, or in the case of



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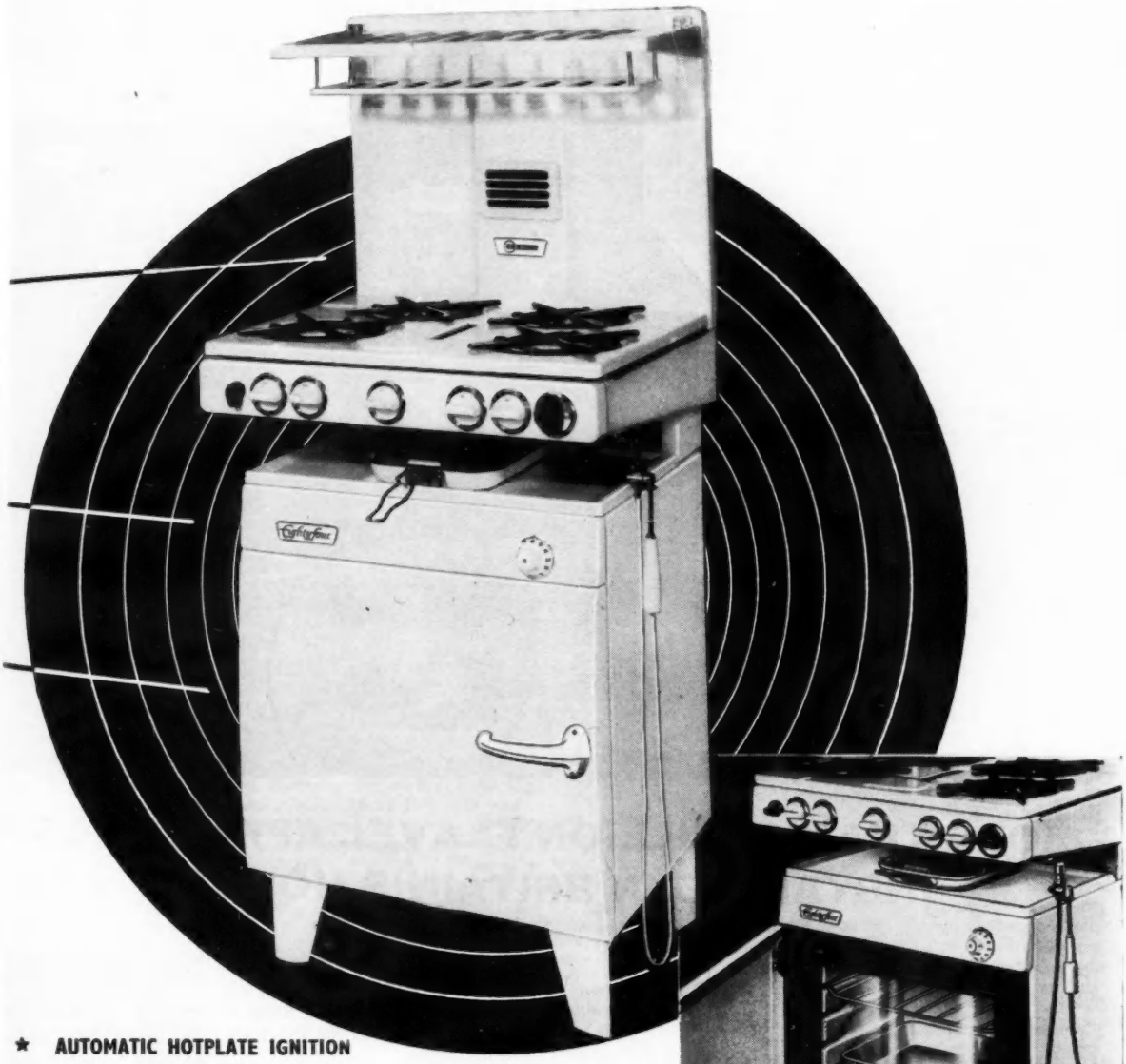

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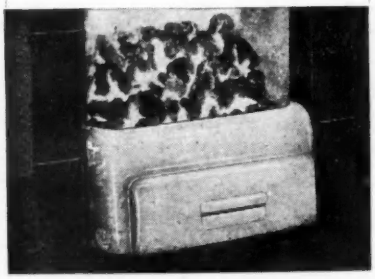

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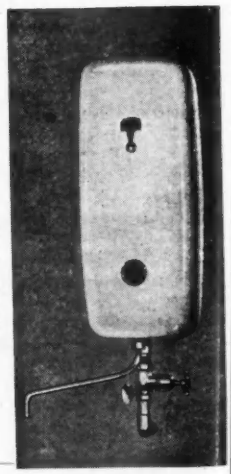

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certain producers (not normally used in the gas industry), which operate to produce fuel gas with the production also of cast blocks of fused ash.

Nearly all fuel ashes undergo partial fusion under conditions of combustion or gasification. The chemical constituents, taken individually, possess widely differing melting points, ranging from the exceedingly high temperatures required to fuse silica, lime and alumina, to the comparatively low temperatures of fusion of the alkalis and of certain silicates. Individual melting points are not so important, however, as the chemical actions of one constituent upon another at the temperature of operation. As an example, lime and silica taken separately are practically infusible at the furnace temperature, but an intimate mixture of the two will fuse at a comparatively low temperature on account of the formation of the low-melting calcium silicates produced by their combination. Liquids formed in this way, moreover, are often capable of taking up particles of solid mineral matter by direct solution.

Ash in Boiler Furnaces

The influence of ash in boiler-furnace practice is an interesting study, since, besides clinker troubles which are similar in nature to those occurring in other types of furnace, deposits may occur in the flues through which the combustion products pass. Such deposits are formed, not only by the agency of true ash, but also from the original ash-forming constituents of the fuel.

The deposition of solid material in boiler tubes of fire-tube and waste-heat types of boilers may cause considerable trouble by restricting the flow of gases and thereby causing back-pressure and reducing the heat-transfer rate from the gases to the water. Provided a regular routine of cleaning and inspection has been established, however, this does not generally cause anxiety, since daily pressure readings, or the fitment of continuous pressure and temperature recorders on the inlet and outlet of the tubes will indicate whether undue accumulation of deposit is taking place. Fire tubes can be cleaned without shutting down the boiler and a rota of cleaning a definite number of tubes daily can generally be arranged so that serious depositions are continuously avoided. It is with water-tube boilers, particularly those designed to operate at high steaming rates, that trouble is often experienced from depositions on the fire-side, or flue-side of the system[8]. Water-tube flue systems vary considerably in layout and in the number of components. In general, however, the items in order of gas flow are:—

(1) Air supply to fuel bed.
(2) Fuel bed.
(3) Tube banks through which the water circulates.
(4) Superheater for raising the temperature of the steam.
(5) Economizer for recovering part of the flue-gas heat and imparting this to the water.
(6) Air-preheater for providing heated air to the fuel-bed.

It is obvious that the products of combustion, after leaving the fuel bed and being laden with ash dust and with volatile components of ash-forming material, will be successively reduced in temperature as they pass on their way to the chimney. The ash dust also contains considerable quantities of unburnt fuel dust in cases where combustion has been incomplete. It is this highly complex mixture of substances of different chemical compositions, sizes of particles and degrees of volatility which gives rise to external deposits on the outside of the water tubes and to accretions on the walls of the flues. Deposition, as will readily be understood, will take place as a series of 'fractionations,' the positions of the fractions depending on prevailing conditions such as temperature, nature of surface and size and shape of ducts. Thus, the larger and heavier particles will be the first to drop out, while the smaller ones are carried forward through the spaces between the water tubes and onwards towards the economizer, air-preheater, and chimney. A different kind of fractionation will be taking place simultaneously by the condensation of the volatile substances, particularly alkali and iron chlorides, which will be deposited in the cooler parts of the system. It is found, therefore, that particular types of deposit are related to specific locations in the plant. Thus, it is found that deposits on the economizer tubes and air-preheaters contain relatively high proportions of chlorides, while on the hotter tubes, such as those of the boiler and superheater, very little chloride is found, but considerable quantities of infusible and non-volatile oxides, clays and similar stable substances are present.

Accumulations on the surface of boiler tubes and in the spaces between the tubes often become seriously enlarged by 'stickiness.' Such a condition arises in various ways and is produced by the mixture of a finely divided solid and a viscous liquid. It may be formed, for instance, when solid particles of a mutually fluxing nature become mixed, and melt under the influence of heat. The molten material encloses particles of solid infusible material such as fly-ash containing carbon and a 'snowball' effect ensues, whereby progressively large pieces are formed, the 'stickiness' of the nucleus trapping flying particles. Another condition in which stickiness may be produced is when volatile mineral products condense out, passing from the gaseous, through the liquid, to the solid phase. In the liquid stage, flying solid particles are trapped and carried forward. A third condition arises on account of the formation of sulphuric acid in concentrated liquid form from the sulphur of the fuel, first by oxidation to sulphur dioxide and subsequently to sulphur trioxide, in which form it reacts with water vapour to form sulphuric acid which collects as a paste with the solid deposits. Owing to the very low volatility of the acid, such a state of affairs produces a deposit which may remain permanently wet. This may be very seriously corrosive to iron and steel structures. On this account, flue gases should not be allowed to cool, especially at times of 'shut-down' or low load, below a definite temperature, known as the 'acid dew point' otherwise condensation of acid will occur and will rapidly ruin the metal parts upon which deposition takes place. It is generally agreed that the flue gas temperature at the air-heater outlet of a modern large water-tube boiler should not fall below 120°C. With Lancashire and some other types of boiler, a higher temperature may be necessary.

With this object in view, boilers fitted with an air-preheater are often constructed so that part or all of the air can be by-passed direct to the fuel bed without passing through the preheater. In this way less heat is abstracted from the flue gases, which pass forward at a correspondingly higher temperature, and acid condensation is avoided. So long as the acid is present in vapour form, corrosion will not be likely to be severe from this source. Where condensation takes place, however, the effects can be very serious.

Significance of Laboratory Tests on Ash

Laboratory tests on ash may include, (1) determination of the percentage of ash produced by the incineration of the fuel, (2) chemical analysis of ash, which can be of varying degrees of completeness and complexity, (3) physical tests on ash characteristics. Such tests and analyses have a definite practical value in correlating large-scale performance with fuel and ash properties, although the limitations of the value of laboratory tests must be realized. Results of tests often require expert interpretation in their application to expected results in practice. For instance, the ash prepared in the laboratory may not be of exactly the same composition as the ash produced in large-scale operations, since conditions of preparation may not be the same. Rate of combustion, temperature and composition of atmosphere may be different: The differences may or may not be important according to circumstances. Physical or empirical tests (as for example the fusion test) may not sufficiently simulate conditions in practice.

As regards determination of the percentage ash in a fuel, it has been recognized that, for consistent and standardized procedure, the conditions of carrying out the test should be rigidly prescribed. This is done in the British Standard method[6]. Edgcombe and Manning[9] have pointed out that differences in determined ash content may occur through losses due to decrepitation if heating is too rapid. Another error sometimes occurs when several coals are being tested in the same furnace at the same time, especially where a large number of samples are ashed by feeding the dishes at the cool end of a 'through' type furnace and removing the ash at the hot end. Sulphur gases volatilized from some of the coals may pass over and be fixed by the inorganic matter of other coals, especially if the latter is at a higher temperature or contains more basic constituents. The authors suggest that such errors can be reduced to a minimum by incinerating the samples in two stages, firstly from cold to 450° or 500° C during 30 minutes and holding at this temperature for a further 30 minutes after which they are

transferred to another furnace at 775°C. and heated to a constant weight. Standardized methods have been described and are in general use for making chemical analyses of coal and coke ashes[3,5].

For purposes of investigation, it is often necessary to determine the amounts of inorganic constituents of coal which may not remain fixed in the ash. For this purpose, methods of ultimate analysis of coal are described in B.S. 1016: 1942 pp. 43-53. In this connection also, Dr. R. A. Mott has published a report[10] on a rapid method of determining pyritic and sulphate sulphur in coal. As regards physical or empirical tests on coal ash, the well known Fusion Temperature Test as specified in B.S. 1016: 1942 is of considerable value in assessing the probability of clinker formation in works practice. This test has been devised after much investigation over the past 30 years, on the relationship between the chemical composition and the clinker-forming tendencies of ash. While certain broad relationships undoubtedly exist, direct forecast from composition is often unreliable. For instance, the sample used in the laboratory for making the pyramids used in the ash-fusion test, is a homogeneous average sample representative of all the ash of the fuel, whereas in the fuel bed itself, the ash pieces and the extraneous impurities are distributed in a heterogeneous manner, and the influence of one constituent upon another may well be different in the two cases.

It has been pointed out[9] that the value of the ash-fusion temperature test would be enhanced if it were possible to introduce modifications to indicate the extent of the variations due to the reactions of the segregated constituents[11,12]. The ash fusion test has been carried out in many forms during the last 25 to 30 years but the generally accepted method used in this country is that of B.S.1016: 1942, which is similar to that specified by the American Society of Testing Materials and, consists essentially in observing the behaviour of a pyramid of ground ash when heated at a constant rate in (1) a mildly reducing atmosphere, and (2) an oxidizing atmosphere and noting the 'initial deformation temperature' (I.D.T.), which is the temperature at which the first signs of fluxing of the tip or edges of the pyramid occurs and the fusion temperatures, at which the whole pyramid collapses into a 'blob'.

Low melting ashes, are in general, likely to give more clinker trouble than those of higher melting point. By the term 'low melting' is understood temperatures below, say, 1150°C. for initial deformation and 1200°C. for squatting. Ashes with squatting temperatures of 1300°C. and over will not generally give clinkering trouble. Probably the most troublesome type of ash is one which has a low initial deformation temperature and a large temperature range between I.D.T. and squatting temperature (for instance, I.D.T. of 1100°C. and squatting temperature of 1350°C.). Ashes of this type first form a 'treacly' product at comparatively low temperatures which entrains the higher melting constituents and eventually fluxes with them. The resulting viscous mass then cements considerable quantities of good fuel into an aggregate which on slightly cooling, will set into large hard concretions which are difficult to remove without wasting unburnt fuel, and which often stick to the brickwork of the furnace or producer and may cause considerable damage to the structure in the course of removal.

An interesting point arises here in the fact that it is sometimes a disadvantage to use a fuel with a very low ash content. When using size-graded coke, for instance, in hand-clinkered producers or furnaces, there may be very little clinker formation with low-ash fuel. The pieces of coke will then gradually burn down to very small sizes, which, being unsupported by clinker, will fall through the bars into the ash-pit. When the fuel bed is disturbed during clinkering or poking, much of this fine fuel becomes lost in the removed ash. Such low-ash fuels are better dealt with in mechanically-operated producers fitted with revolving grates.

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REFRACTORIES FOR GAS RETORTS *From p. 455.*

should be, or if there was a thick brick on one side and a thin one on the other, the joints were not even. So far as jointing material was concerned workmen liked a material which would spread like butter. If dry and sandy it was difficult to put on, but it might stand up better in practice.

Temperature fluctuations during heating up could cause a lot of trouble, but he did not think this was a cause of spalling. He did not think scurfing had much to do with it either. The most serious cases of spalling occurred in earlier designs of downwardly-heated retorts where in the upper zone of the retort there was a very steep temperature gradient through the retort walls. On the combustion chamber side there was a temperature of about 1,350°C., while the retort face was in contact with virtually cold coal—he thought it quite likely that just behind the retort face the temperature fluctuated in a critical range and caused a bursting-off of flakes. The fact that flakes of silica were sometimes found adhering to scruf was readily explained if those flakes were already loose before the scurf was deposited.

Mr. A. R. Myhill asked what were the limits in the manufacture of higher bulk density and lower permeability silica bricks with reference to durability, mechanical strength and thermal properties.

Mr. J. Corrigan, in proposing the vote of thanks to Mr. Oliver and Dr. Carr, said the paper contained much useful data of reference value both to experienced engineers and to students; it had been a useful curtain-raiser to the works visit.

Mr. A. D. Duxbury, who seconded, said they were familiar with the problems of refractories from the standpoint of carbonization, but the problems which the requirements of the gas industry imposed on manufacturers of refractories were not so easily understood.

Mr. Frank West said efforts were constantly being made to provide refractories that would last longer and give more satisfactory service. This was their constant endeavour. They aimed to keep abreast of new developments and to put these into operation at the earliest possible moment.

SAFETY REGULATIONS FOR GASWORKS—From P. 456.

are fitted. Safety regulations to be observed when gasholders are under repair are covered in England by Safety Recommendations and particularly by Reports of the Gasholder Committee (I.G.E. 144). Sweden and other countries have rules laid down by the Gas Association of similar scope.

Question 14 asked: 'Is there at the works a diagram hung up in a visible manner in which the whole installation of the works with communicating pipe systems is marked, so that the persons assigned to that job are completely familiar with the place of these pipes?' The answers are not given but it is stated that 'in all middle-sized and large works such a diagram is present, but this is by no means everywhere hung in a visible manner.' The best practice in this country seems to display complete drawings of connections at every important point on the gas line.

The final question asked whether current safety regulations are communicated in writing to the personnel concerned. The English reply, to our surprise, is reported as: 'Normally not, except for special work (see I.G.E. Safety Recommendation p. 1) for shutting out, opening and purging of a purifier.

The Future of the South West*

By W. B. CLARIDGE‡

WE are all familiar with the energetic policy pursued by the Board in carrying out large scale integration and the closing down of many uneconomic manufacturing units throughout the area. The ceremony at Beacon Hill, near Shepton Mallet, bore testimony to the magnitude of this task when the final link in the first thousand miles of main laid since vesting date was made by Sir Harold Smith, Chairman of the Gas Council. It is obvious that the full benefits of this vast scheme will not be reaped immediately. But we believe that the lower costs of the major manufacturing stations, and the improved quality of the gas supplied, will enhance our prospects of considerably increased business—both from existing consumers and from new business in those villages and hamlets formerly without a gas supply.

Growth of Gas Sales

At this point I would refer to similar schemes of a smaller nature which were initiated by the Chairman of the Board, Mr. C. H. Chester, some twenty years ago following the amalgamation of a number of undertakings with the former Swindon United Gas Company. From my personal knowledge of these schemes and the results obtained during the intervening years, I think you will be interested in some figures which show the growth of gas sales in various units from the date of integration to 1954.

	Therms Sold	Year	Therms Sold 1954	% Increase
Highworth	26,264	1935	133,223	407
Faringdon	67,069	1935	166,482	148
Marlborough	154,216	1935	279,814	81
Wootton Bassett	47,305	1936	122,233	158
Fairford	24,140	1936	73,150	203
Cirencester	391,416	1937	800,412	104

There have, of course, been varying degrees of development in each of the places mentioned, but the improved service resulting from integration has played a major rôle in the promotion of gas sales. It is also interesting to record that the existence of high-pressure mains in rural districts has encouraged industrial and other large-scale development. Two instances where this has occurred within the Swindon District concern an aircraft factory and a War Department station where the respective annual gas requirements have now reached approximately 329,000 and 893,000 therms. These loads were not envisaged at the time the integration mains were installed but can be quoted as typical examples of future possible developments *en route* of the area integration mains.

Competition

As time progresses we are confronted with more and more competition and due to the advanced technique in the utilization of solid fuel, electricity and oil, the consumer has now a wider range from which to choose his fuel requirements. Let us for the sake of argument assume that efficiency of utilization had reached a common standard throughout each of the fuel industries. The design of the particular appliance, speed of operation, cleanliness in use and other factors would each make their individual appeal, particularly to the domestic consumer. Undoubtedly, however, the most important feature would ultimately prove to be the cost of the fuel. At the present time everyone is becoming increasingly 'cost-conscious,' and although we can offer two first class fuels and highly efficient appliances for use in the home, we need to pay the closest attention to our various charges if we are to challenge successfully the services offered by our competitors. In the industrial field the use of gas has become increasingly popular and there is unlimited scope for future development provided our tariffs remain competitive.

It is significant that, on each occasion there has been an increase in the price of coal, an adverse differential has been levied on the gas industry. While it is difficult to foresee that any alternative to coal will provide our basic raw material for a long period ahead, the continued rise in cost inevitably drives our minds to such possibilities.

In fact, plans for producing gas from oil have been accelerated and a large plant is in process of installation at one of the major works in this area. Meanwhile, the search for natural gas continues and experimental work is in hand for the complete gasification of weakly caking coals, types not used hitherto by the gas industry. A point of considerable interest is the reference made by the Minister of Fuel and Power to the possible transport of liquefied methane from the Middle East.

The industry has been charged for the time being with the responsibility of producing more solid smokeless fuel in order that the provisions of the Clean Air Bill can be implemented at the earliest possible date. The better utilization of coke has already assisted in this direction and with the improved design of both open and closed type appliances, our solid smokeless product is in much greater demand, particularly for domestic purposes.

Sulphur Content of Gas

Most of us I think favour the virtual removal of organic sulphur from town's gas, but what progress are we making in this direction? It has been the subject of a great deal of discussion, but I suggest that plans need to be hastened for ridding ourselves immediately of this undesirable constituent.

It is in the domestic rather than the industrial field that we are most vulnerable so, if we are to advance or even maintain our present position, I suggest it is not a matter of whether we can afford the cost of sulphur removal but that we cannot afford to allow it to remain.

It is true that the existence of a large number of relatively small manufacturing units has made the solution of the problem most complex. But as these disappear with the completion of the area integration scheme the matter of sulphur extraction will concern only the remaining major production stations.

Gas Tariffs

In our revised domestic tariff the Board has taken measures for the recovery of certain charges from the uneconomic consumer, but further steps in this direction may be necessary if we are to be in a position to offer more attractive terms for the development of the domestic hot water and space heating loads. Such a procedure would, without doubt, result in the loss of a proportion of small consumers and perhaps be the subject of political controversy on the grounds of alleged hardship, but any possible methods of obtaining a higher level of consumption in the average household need our serious consideration. In effect, I suggest we need the equivalent of the most equitable minimum charge to be followed by the lowest economic rate for our commodity in order to present our domestic tariffs in the most competitive form.

Much publicity has been given recently to the arrival of the atomic age and the part that nuclear power will play in the solution of our fuel problems. Developments in this field will be necessary if the industrial life of this country is to expand or even be maintained in the years ahead, but I see no reason for our young personnel to have any qualms as to the future of the gas industry during their life-time. We have been faced with many problems in the past and overcome them successfully and I am quite optimistic concerning our ability to counter those of the future. The field of research must be widened and opportunities for training of personnel increased, but whatever facilities are provided the results will depend mainly upon the zeal with which all ranks tackle their respective tasks.

* From the Chairman's Address to the South Western Section, I.Gas.E., delivered at Swindon on October 19.

‡ Divisional Engineer and Manager, Swindon.

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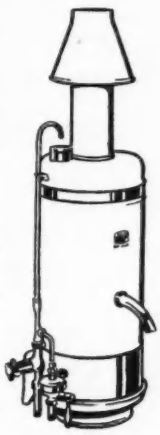

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New Aspects of Distribution Technique

Discussion on the paper by A. D. L. Copp, A.M.I.C.E., M.Inst.Gas E., Distributing Engineer to the North Thames Gas Board, 'Some New Aspects of Distribution Technique,' the latter part of which we published last week.

DR. J. BURNS, G.M., Chief Engineer, North Thames Gas Board, opening the discussion, drew attention to the thoroughness with which the author had tackled the many practical problems that he had described in the paper. The primary aim in designing and constructing a distribution system was to ensure minimum capital and operating costs. The work illustrated in the paper might have useful applications on the production side also. The annual cost of replacement due to corrosion of plant was prodigious. Present day distribution practice involved a wide knowledge of civil, mechanical and chemical engineering, and the author was to be congratulated in presenting a very valuable paper.

Colonel J. A. Gould, M.C., Distributing Engineer, South Eastern Gas Board, asked if the gamma-ray inspections were notified in the pipelaying specifications, and referred to the slowness of completing a welded joint compared with flexible cast iron joints. He wondered if a cleaning 'pig' could negotiate the small radius of a welding fitting bend to which specification steel pipes were bought. He spoke of the excellent results he obtained by moulding protection of joints and couplings, and of the long-standing benefits accruing from coating the insides of both steel and cast-iron pipes with red-lead paint.

Mr. H. J. Escreet, North Thames Gas Board, after saying how pleased he was to see Mr. Webber occupying a very well-deserved place in the Chair of the Section, went on to compliment Mr. Copp on his courage in developing new ideas and the patience and attention to detail he had shown in the work. This was particularly so with his efforts to control the standard of electric welding. Less trouble occurred in earlier years due to the more common use of gas welding and the lower pressures carried by the mains. The author's frank statement of results on his work with cathodic protection clarified the position and countered earlier misleading statements. It would appear that the efficiency of cathodic protection still depended on the initial efficiency of the pipe wrapping. Given good wrapping, cathodic protection might be worth while—time would tell. Cathodic tests might form a useful guide to the efficiency of the wrapping. With regard to steel bends, the old type factory-made bend was a better job but the wrapping deteriorated in store. The site fabricated bend saved storage space and economized in steel. Mr. Escreet said he had found the Short's gas leak detector adequate for normal purposes, particularly as there was an economic limit to the size of leak which required repairing and which the more sensitive instrument would detect.

Mr. F. T. Buist, South Eastern Gas Board, said Mr. Copp's paper suggested that they were on the threshold of still wider developments in distribution practice. He agreed with Colonel Gould that the moulding of joints was very successful. The use of plastic materials for pipe wrapping would be considered if time did not show the plastic to become brittle.

Mr. N. T. Wait, Eastern Gas Board, suggested that the use of sleeve inserted joints on steel tubes which were then welded might make a better joint than the butt welded type, being more reliable without the careful testing involved in the latter.

Mr. K. L. Clark, North Thames Gas Board, referring to the case of distribution systems at high pressure for gas storage, said that this practice had been necessitated in Berlin after the war, and data from this experience would be valuable.

Mr. R. Summerson, Eastern Gas Board, referred to Mr. Copp's remarks on welding technique in relation to stress corrosion of mains on works with ammonia present in the gas. This problem did not appear, however, to prevent the development of purifier construction in mild steel.

Mr. E. O. Rose, Eastern Gas Board, commented that the drawback of the highly sensitive gas leak indicator was that it picked up leakage gas in small quantities which filtered considerable distances along the main. He suggested that the pipe hangers illustrated in Fig. 7a of the paper could be used preferably in suspension since careful consideration would have to be given to eccentric loading due to movement of the main when used in the support position. Could Mr. Copp give any details of problems due to dust in mains deriving from gas drying? He compared 'line-packing' of pipes with the provision of high-pressure holders.

Mr. J. M. E. W. Webber, South Eastern Gas Board, referring to the use of mains for gas storage, queried the basis of design of a system which might have its pressure raised from 20 lb. per sq. in. to 100 lb. per sq. in., particularly with reference to the increased stress at bends in the pipe line.

Mr. Copp, replying, said that Dr. Burns had rightly referred to the ultimate aim of any distributing engineer, to distribute gas as cheaply as possible, cheaply in the comprehensive sense, and he was glad to hear that the paper contributed to that aim. Colonel Gould was right to emphasise the advantages of internal coating and of moulding joints. Pipes were ordered to the dimensions of B.S. 1600 and the quality of B.S. 1601; provision for welding inspection was in A.P.I. 1104, and the speed of welding was a matter of the technique used—stove pipe welding proceeded at the rate of about 15 in. per minute. Articulated 'pigs' would travel around quite small radius turns provided they were 'fire bends' and not 'lobster backs.' He was particularly glad to welcome Mr. Escreet, as the developments described were a continuous process, and so many originated under his direction. The efficiency of the serving on pipes could be evaluated from the current drainage needed to make pipes sufficiently cathodic. Original faults in servings were often very serious, and with transit drainage added, much of their pipe had 'holidays' averaging 18 in. apart. Mr. Buist had raised the matter of plastic wrappings. The Board was very interested in these, and he hoped some success would be achieved. The author said he could not agree that inserted sleeve welded joints were able to give 100% strength of the pipe. Hydrogen blistering was apparent only when six conditions were fulfilled, and one of those was defective root bead weld resulting in a void in which nascent hydrogen could form. It was not possible to serve pipes without any fault, so that cathodic protection of steel was necessary in any but non-corrosive conditions. Good serving resulted in fewer anodes or less applied current.

Mr. Rose had suggested that the support shown in Fig. 7a of the paper would be better upside down. From the point of view of stressing due to eccentric loading it would make no real difference, because this was allowed for in the spring scantling, but it would require a longer stanchion with a somewhat clumsy top to it. Dust in pipes was a problem and, after drying gas had been instituted, it became severe for a long period until one way or another it was taken out of the system. They had had difficulties resulting from dust entering compressors; there were some extractors available of the wash-oil variety which extracted all the dust down to micron size and which required the application of no external power for their operation.

Mr. Webber had raised the question of putting up working pressures and of anchoring bends. Any pipeline, the joints of which were welded to the standard of A.P.I. 1104, did not need any anchoring at bends; the working pressure could be raised with confidence until it reached that at which the stress in the pipe walls equalled 72% of the yield stress of the steel. However, where the quality of joints and their resistance to mechanical stress was unknown, great caution should accompany any unusually large increase in the pressure of the gas.

The One-pipe Installation Principle

By HELMUT JANSSEN, G. Kromschröder A.G., Osnabrück,
(through Tekon, 50, Baker Street, London, W.1.)

GAS and water meters and other flow-through appliances, when rigidly connected to separate inlet and outlet pipes, are generally subject to severe stresses which may distort or disrupt the meter case or joints. Rigid connection may also cause difficulty in removing and replacing meters. Lead has virtually disappeared from the gas installation, except for two lengths of lead pipe and four lead joints—to relieve installation stresses and to simplify fitting and exchange of the gas meter. This vestigial lead usually accounts for at least half of the cost in labour and material used in fitting domestic meters, needs an additional trade, and complicates stores and accounting procedures.

In other countries, lead has disappeared entirely from the gas installation and this may have resulted in more attention being paid to the avoidance of stress on the meter and to the design and use of meter bars. The amount of stress transferred to the meter bar will depend on design and on the skill of the pipe-fitter, who is not accustomed to working to a few thousandths of an inch and who needs to be educated to make the best use of the meter bar. Unless the inlet and outlet of the meter are truly vertical and in alignment in all planes, a meter bar connection may not be stress-free or even gas-tight except by flexible connection or by skill seldom to be found in the general run of pipe-fitters on the district.

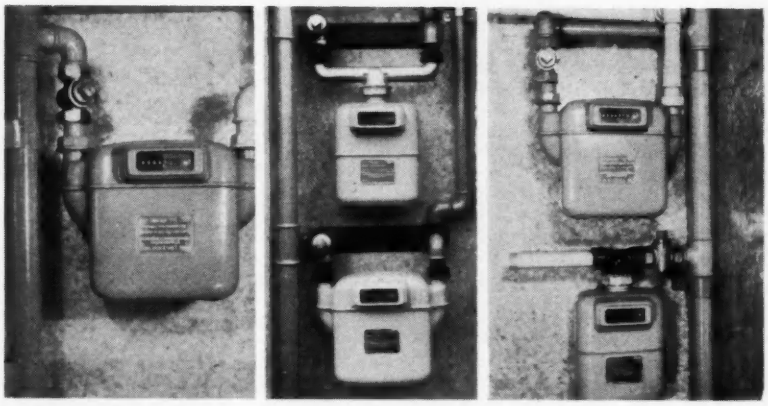
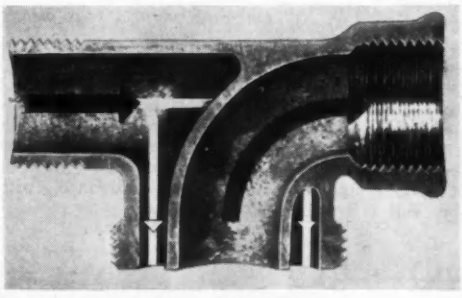
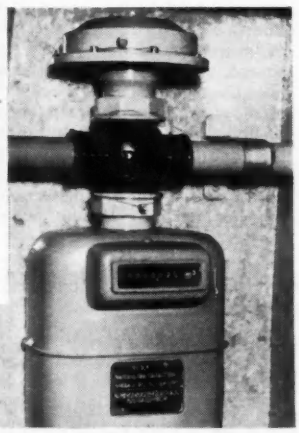


Fig. 5 (left): *Traditional, service on left, stressed, eight fittings.* *Fig. 6* (centre): *Meter bar, one pipe, with adaptor.* *Fig. 7* (right): *Service on right. At the top is a two-pipe stressed installation with ten fittings, below is a one-pipe stress-free installation, with four fittings.*





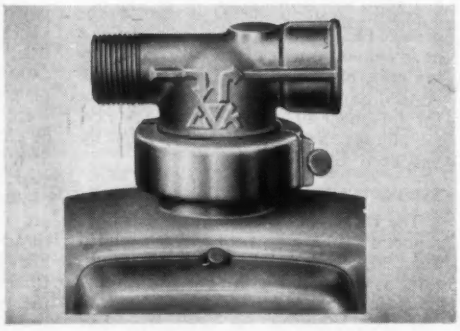


Fig. 1 (top left): *Section through two-way coaxial tee.* *Fig. 2* (below left): *Consumers' control coaxial tee and meter.* *Fig. 3* (top right): *Coaxial cross with service governor and meter wired and sealed.* *Fig. 4* (below right): *Alternative seal ring.*

When the service pipe is to the right of the meter, and/or if the installation pipe is to the left, the crossing over of pipes is not only most unsightly but also is an additional cause of stress and may require still more pipe fittings and joints with higher cost and more chance of leakage.

Stress-free Installation

If the meter inlet and outlet are from a common centre at the pipeline (one-pipe connections) there can be no installation stress on the meter and the use of lead pipe, lead joints, lead/iron fittings, and additional skill, becomes superfluous. No questions arise as to tolerances on location of meter inlet and outlet, nor is the meter 'handed' but may have inlet in any desired direction.

The service pipe may be connected to the installation pipe, from the outset and permanently, by a two-way coaxial tee of say 1 in. inlet, 1 in. outlet, and 2 in. (coaxial inlet and outlet) branch. Such a fitting, in malleable iron, resembles in all external respects an ordinary tee with which the pipe-fitter is familiar and which he uses without difficulty or special instruction or supervision. He may fit temporarily a 2 in. socket and short length of pipe to the branch, in place of the cover with which the fitting is issued, to protect the jointing surfaces and to help square up the fitting. (Figs. 1 and 2.)

The joint faces of the coaxial tee are machined so that the inner ring projects about eight-thousandths beyond the outer ring. The inner joint is made first and more tightly. Both are protected by a cover which is removed only after the tee has been fitted as a permanent part of the pipeline, with joint faces downwards. A malleable iron sealing cap with suitable

gasket is then fitted, tested, and sealed until the meter is fitted by one connection. (Figs. 3 and 4.)

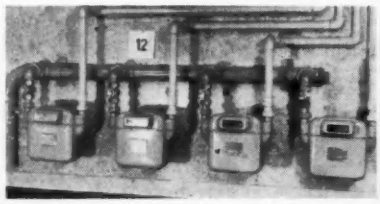
The gas meter has a corresponding coaxial connection—the outer ring being the inlet to the meter case and the centre being the outlet pipe. The joint faces are machined level and a suitable gasket is held to them by a press ring. A screwed plug prevents entry of foreign matter and protects the gasket until the meter is fitted to the coaxial tee.

The meter is connected to the coaxial tee either by one union nut (with or without locknut, set screw, or other locking device) tightened by the standard set spanner for appropriate nut, or by one pair of flanges. Whether rotation about the axis of the joint is to be permitted before tightening or not seems to have been decided in other countries in favour of rotation—but if the joint is required to be fixed against rotation, this can easily be arranged without impairing the principle. A further advantage is that there is no risk of sparking from stray electricity when changing meters because electrical continuity is maintained at all times from installation to earthed service—not as now.

The same one-pipe principle is applied to consumers' control, service governor, or other ancillary; corner and other pipe fittings of coaxial type may be used to reduce the number of separate pieces and joints, materials, and labour, associated with traditional installation.

For a number of reasons quite unconnected with the merits of the goods themselves, the import of meters and fittings into this country on any extensive scale is unlikely. It may be that meters, modified as may be necessary to suit British requirements, may be imported for large-scale district trials and as a stop-gap until production is established on an adequate scale in Great Britain.

A wide variety of applications of the one-pipe principle, in coaxial and other forms, are subjects of patents and patent applications, some of which may not be published for two years, in all principal countries, in a number of which the principles are already applied in manufacture under licence agreements.



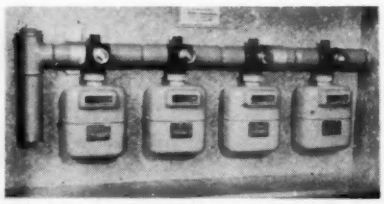


Fig. 8 (left): *Traditional, horizontal four meters, 37 fittings.* *Fig. 9* (right): *One-pipe horizontal four meters, 14 fittings.*

The Principle in Practice

In countries using the one-pipe principle, application has followed a clearly defined and logical pattern from large-scale district trials to new installations being fitted with the one-pipe connection as a permanent part of the pipeline. Existing installations have been left until alterations or renewal became necessary for other reasons and were then brought up-to-date by simple and cheap conversion to the one-pipe system.

Simple adaptors have been developed to allow two-pipe meters to be fitted to a one-pipe installation, and vice-versa, to overcome any difficulties with mixed stocks or lack of one-pipe meters in the initial stages. Until enough one-pipe meters can be had, existing types can be fitted with adaptors—either at manufacturers' works or in the meter workshops of gas undertakings. This avoids, at source, any stressing, and it is no longer possible for the pipe-fitter, gas fitter, or plumber, to stress the meter by the way he fits it on the district. Installation with two-pipe meter with adaptor is likely to cost less in total than present methods, and development of meters with one-pipe connection, without adaptor, will reduce costs still more, as has been found already in other countries.

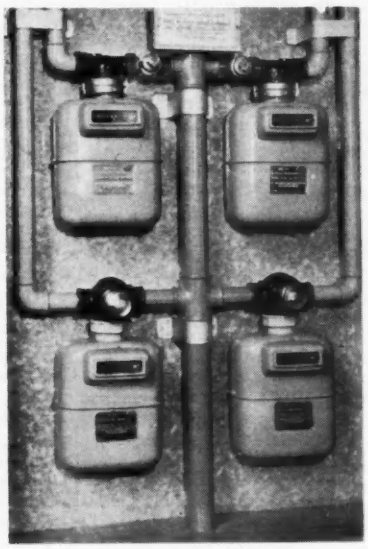


Fig. 10. One-pipe, vertical four meters, 21 fittings.

The object of this article is to illustrate principles and ideas for the simplification and improvement of installation practice, with a view to finding ways of applying them in accordance with British needs and wishes.

COMPANY NEWS

BRISBANE GAS

At the 91st Annual General Meeting of the Brisbane Gas Co., Ltd., the directors reported a profit of £84,835 for the year ended June 30, 1955. After making a transference to the reserve fund and paying interim and final dividends (totalling 7% for the year), and adding the amount brought forward from the previous year, a balance of £1,232 is left to be carried forward. Sales of gas amounted to £948,189, being an increase of £35,981 over the preceding year. Revenue from other sources, including sales of residual products and appliances, amounted to £40,855. During the year the Company has laid reticulation mains in 18 new estates containing an aggregate of 1,445 building allotments, thus having gas available for houses to be constructed on these allotments. Mains laid during the year totalled 25 miles in length. A new fitting shop has been established in a central position at the works to improve facilities for construction and maintenance work. Two coke de-breezing units have been ordered, one for the vertical retorts house producers, the other for treatment of coke for sale. A new tar storage tank of 80,000 gal. capacity has been completed.

THOS. WARD

The Directors of Thos. W. Ward, Ltd., report a Group profit for the year ended June 30, 1955, of £1,136,972 after taxation, as compared with £788,490 for the preceding year. A full year's dividend has been paid on the preference and employees' shares, together with an interim dividend of 3¾% less tax on the ordinary share capital, amounting in total to £89,306. The payment of a final dividend on the ordinary shares of 11¼% less tax amounted to £142,312, and the payment of a final dividend of £12 1s. 3d.% on employees' shares, tax free, was £8,614. After transferring £400,000 to the general reserve a balance of £567,169 was left to be carried forward. The parent company's turnover at £21¼ mill. shows an increase of some £800,000 compared with the previous year, while the profits before taxation, excluding dividends from subsidiaries, are up by over £200,000. The Group turnover of £36% mill. is some £6 mill. higher than the preceding year. The Chairman, Mr. H. W. Secker, said that the policy to extend the Company's interest by the further acquisition of subsidiary companies had been implemented to the full during the year, and over £1,100,000 had been expended in this purpose.

GERMAN ENGINEERS VISIT YORK SEGAS PLANT

Left: A group of German engineers inspecting the SEGAS plant. Right: Dr. Deneke of the Hameln gasworks, speaking at the dinner given for the German engineers by their hosts at the Royal Station Hotel, York.

Hameln (better known as Hamelin, home of the Pied Piper) have recently ordered a SEGAS plant. Didier-Werke A.G. hold the manufacturing rights in Germany of this plant from the Power-Gas Corporation Ltd. of Stockton-on-Tees. In connection with this a party of German gas engineers visited the York plant on November 10. The previous evening Power-Gas Corporation Ltd. entertained their visitors to dinner in the Royal Station Hotel, York. Despite some language difficulties it was a great success.

After the dinner Mr. R. W. Rutherford (Deputy Managing Director, Power Gas) welcomed the guests and said he hoped their visit would enable them to see the great possibilities of the SEGAS process. Mr. N. C. Sturrock (Group General Manager, York-Harrogate Group, North Eastern Gas Board) welcomed them on behalf of the Board and his group and said they could see and ask as much as they wanted. Mr. J. B. McKean, whose work on SEGAS in the South Eastern Gas Board's area is well-known, paid tribute to the York plant and the North Eastern Gas Board and Power-Gas. Mr. Karl Schilling (Dider-Werke A.G.) and Dr. Deneke (Hameln gasworks) thanked everyone for their help and said how much they were looking forward to seeing the plant. Also present at dinner were Mr. F. H. Nicholls and Mr. W. Carlisle, both of York. In an early issue we will be including an article by Mr. P. C. Egan of the North Eastern Gas Board, who will be describing some of the more technical aspects of this plant.

Coke Oven Managers' Dinner

The annual gathering of the Coke Oven Managers' Association took place on November 9 and 10 in London and culminated in the usual dinner at the Waldorf Hotel. As customary, the members of the Association were in festive mood, relaxing after the two days of business and meetings. During the first of these a paper, 'Coke Ovens as Gas-manufacturing Plant' was presented by G. Dougill and A. C. Nelson of the North Thames Gas Board to a joint Meeting of the Association and the Institution of Gas Engineers; an edited version of this paper will appear in a later issue of GAS JOURNAL.

After the dinner the toast of the Coke Oven Managers' Association was proposed by Mr. A. H. A. Wynn, Scientific Member, National Coal Board. Mr. Wynn spoke of the importance to the nation of the coking industry and of the necessity for it to obtain the recruits which it requires. He suggested that the industry should be more boastful of its achievements, and not allow the more 'glamorous' industries to take all the best men. Mr. Wynn also referred to the Clean Air Bill and to the work which the National Coal Board had undertaken in preparing solid smokeless fuels from low rank coals at the Stoke Orchard laboratories.

Replying to Mr. Wynn, Mr. R. J. Barritt, President of the Association, said that he thought the answer to the domestic fuel problem lay in high prices and local compulsion, *i.e.*—smokeless zones. Significantly, Mr. Barritt affirmed that if the coal industry was to become a supplier of smokeless fuel it must take on the attributes of a supplying industry in relation to that fuel as well as to coal. Of particular interest in the President's remarks were his reference to labour relations in the coking industry—the first time that the subject had been mentioned at a Coke Oven Managers' Dinner. Mr. Barritt reminded his audience that for 50 years there had been no strike in the coking industry, although unfortunately this excellent record had been marred by a recent stoppage in South Wales. He pointed out that whereas the worker in the coking industry had, in former times, an advantage in his steady rate of pay this would seem no longer to be the case when one compared his conditions of pay with those in the coal mining industry. It might well be, Mr. Barritt thought, that excessive centralization of labour organization was partly to blame for what unrest there had been, and that negotiations between management and men could be faster. He thought that the family feeling which had prevailed for so many years between the coke-oven manager and his men was of great value, and should be fostered.

Later speakers were Mr. M. D. Edington, Senior Vice-President of the Association who proposed the guests, and Mr. L. O'Connor, C.B.E., Deputy Chairman and Director, British Coking Industry Association, who replied.

PAVIORS' LADIES' BANQUET

Pictured at the Ladies' Banquet of the Worshipful Company of Paviors, held at the Mansion House, on November 1, is Sir Harold Smith, Chairman of the Gas Council, who is Master of the Company, with (right) Lady Smith, and (left) Lady Maud, wife of Sir John Maud, Permanent Secretary to the Minister of Fuel and Power.

News in Brief

All enquiries regarding Cox Ovenbuilders, Ltd., should be addressed to the Sales Divisional Offices at 1, Newbold Terrace, Leamington Spa, Telephone No. 3091. The Company is now a member of the Flavel Group.

The Minister of Fuel and Power has re-appointed Dr. C. J. T. Cronshaw of Prestwich, Lancashire, and Mr. J. H. T. Goldsmith of Fallibroome, Macclesfield, to be part-time members of the North Western Gas Board. The appointment of Mr. Goldsmith will date from December 1, 1955.

Honeywell-Brown, Ltd., announce the appointment of Mr. E. B. Foskett to the management of their Glasgow office. Until recently the Glasgow office was under the management of Mr. D. J. Venning, who has left to accept a senior appointment in the Company's Head Office at Perivale, London.

The National Coal Board met the Executive Committee of the National Union of Mineworkers on November 10, when the Union explained their proposals contained in the new 'Miners' Charter' for progressive realization. The Board undertook to examine these proposals, and a further meeting will be held in due course.

Complete sets of the reports and papers presented at the recent 6th International Gas Conference in New York, together with the Proceedings of the Conference (when available), are still obtainable (price 20 dollars per set, post free). Application should be made to Mr. Bruce A. McCandless, Conference Secretary, American Gas Association, 420, Lexington Avenue, New York 17, N.Y.

A. M. Lock & Co., Ltd., electronic engineers of Chadderton, Oldham, are extending their organization to meet the increasing interest in electronic devices in the North. Their Works and Service Department now occupy the whole of the premises in Crompton Street, Chadderton, and new offices have been opened at Prudential Buildings, 79, Union Street, Oldham, to accommodate the Sales and Accounts Division.

Licensing authorities for goods vehicles report that last year, despite some general improvement, standards of maintenance of a large proportion of goods vehicles, particularly 'C' licensed vehicles, engaged in retail deliveries and similar traffics, continued to be disappointingly low. This point is made in the Summary of their Annual Reports for the year ended September 30, 1954, published by H.M. Stationery Office, price 2s. 6d. net.

A team from the gas industry from Liverpool will be competing tomorrow at the Porchester Hall, London, W.2, in the final competition for the challenge trophy of the Grand Priory in the British Realm of the Most Venerable Order of Hospital of St. John of Jerusalem, which is probably the premier award in the first-aid field. The challenge trophy will be presented by the donor, H.R.H. the Duke of Gloucester, who is the Grand Prior of the Order.

Barbados Gas Company

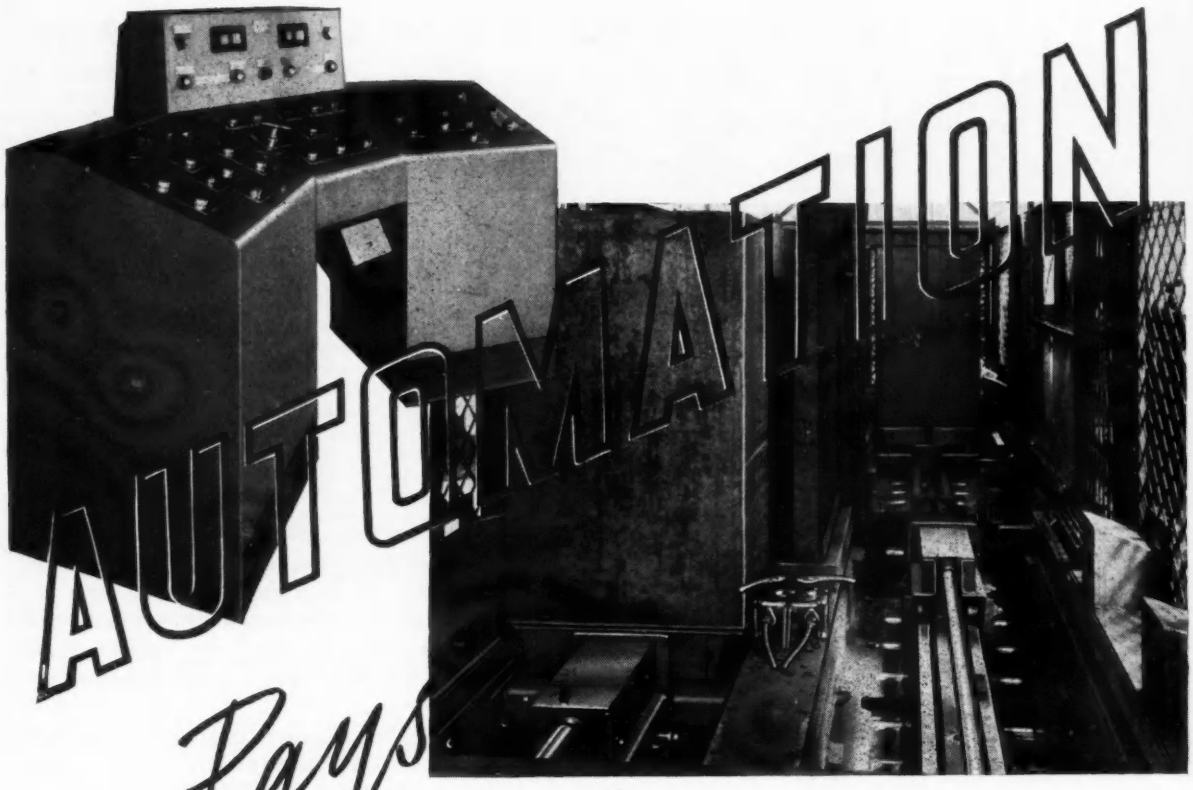
From the Island of Barbados in the British West Indies, the London office of the Gas Company has recently received confirmation that its gas undertaking in Barbados has been acquired by the Natural Gas Corporation of Barbados. This transaction is the result of negotiations initiated by the Chairman of the Company, Mr. E. C. Woodall, when he visited the Island early this year, and is the final outcome after years of endeavour by the Directors of the London Company to raise capital required for the development and extension of the business under private ownership. It is expected that in due course the British Company will be voluntarily wound up.

The original Company was formed in the 1870's, and after many years of fluctuating fortunes was taken over by the parent Company in 1907. From that time on its progress was at least continuous if at times variable owing to factors over which the Company had no control. After the last war, when the cost of importing coal and manufacturing gas became prohibitive, the Company ceased to manufacture gas and took advantage of the supplies of natural gas obtainable within the Island. New mains were laid and new meters installed and every appliance converted for the utilization of undiluted natural gas of 1,050 B.Th.U.'s. Supplies were furnished to a large number of new consumers, but the capital outlay exhausted the resources available to the Company at the time. It was expected that fresh capital could be found in London or Barbados for further development, but for a variety of reasons such capital has not been forthcoming. The only means of ensuring that the supply would be utilized to the full for the benefit of the islanders was to dispose of the undertaking to a body possessing capital powers who could finance a large programme of renewals and extensions.

The Natural Gas Corporation is such a body, being a Government Corporation set up in 1951 under a special Act of the Barbados Legislature, following upon the nationalisation of all the mineral resources of the Island, including the natural gas supply. The Corporation has announced that, consequent upon the acquisition of the Company's business, it proposes to spend a considerable sum on mains and services and general development projects.

Gas Officers Guild

A Special General Meeting of the members of the Gas Officers Guild will be held on November 22, 1955, at 5 p.m,. at Church House, Westminster, London (in Room 6 which adjoins the Bishop Partridge Hall), during the course of the Autumn Research Meeting of The Institution of Gas Engineers and immediately on the termination of the afternoon session. The main business will be to receive a report on issues and Officers' Side claims before the Senior Gas Officers' Joint Council, and to discuss such issues and claims.



COAL OUTPUT UP OVER 100%!

AT RAWDON

	BEFORE re-organisation	AFTER re-organisation	
MEN ENGAGED IN HANDLING			
ABOVE	66	8	MANPOWER BALANCE UPGRADED TO COAL-FACE WORK
BELOW	48	8	
NUMBER OF TUBS/CONTAINERS	650	6	INCREASED SAFETY WITH LESS MOVING MACHINERY
MAXIMUM TONNAGE PER HOUR	148.5	360	WOUND THROUGH ONE SHAFT INSTEAD OF TWO

THESE OUTSTANDING FIGURES—*reproduced by permission of the National Coal Board — illustrate the economy and efficiency of the Torley Container Automation powered and controlled by Keelavite Hydraulics at Rawdon Colliery in Leicestershire.*

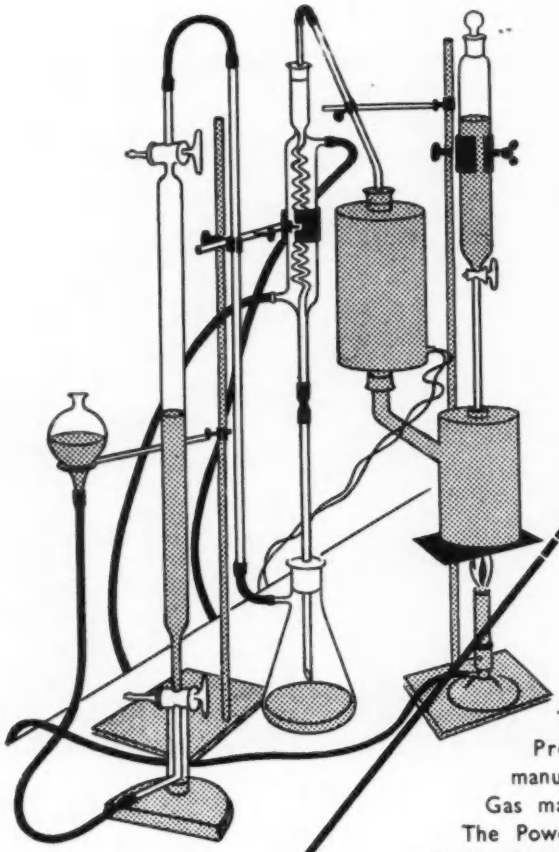
Plan right with

Keelavite *hydraulics*

THE RECOGNISED AUTHORITY ON HYDRAULIC POWER TRANSMISSION

KEELAVITE ROTARY PUMPS & MOTORS LTD., ALLESLEY, COVENTRY, ENGLAND . . . . Telephone: Meriden 225-6

Cogent



RESEARCH

A BRITISH PROCESS

SEGAS

In the years 1945 to 1947, the shortage of gas coal coupled with an increasing availability of Petroleum products from the new U.K. Oil Refinery Programme, led to research in the use of the latter for Town Gas use, in the Laboratories of the South Eastern Gas Board.

This work led to the development of the Segas Catalytic Process and a basis was established for the successful manufacture of Oil Gas, suitable for distribution through Town Gas mains by itself or mixed with other manufactured gas. The Power-Gas Corporation Limited were invited to collaborate in the design and manufacture of a prototype commercial plant of this entirely British Catalytic Oil Gas Process.

DEVELOPMENT

At first, THREE-VESSEL installations were erected and are giving good results but that design has now been superseded by a TWO-VESSEL Regenerative Plant incorporating a separate chamber for the vaporising of oil in steam.

The Segas process is being used for the production of gas from a wide range of refinery products, at a price which currently compares favourably with every other known method of gas manufacture.

SEGAS

Catalytic Oil-Gas Process

PGC

THE POWER-GAS CORPORATION LTD

DESIGNERS AND MANUFACTURERS OF GAS PLANT FOR OVER 80 YEARS

STOCKTON-ON-TEES AND LONDON

AUSTRALIA · CANADA · INDIA · FRANCE · SOUTH AFRICA

229

GAS EXHIBITION AT WESTMINSTER TECHNICAL COLLEGE

An exhibition of gas service equipment, to be seen recently in the library of the Westminster Technical College, was arranged by the Librarian of the College, Mr. G. H. Wright. The exhibits were mounted on two stands. On one of the stands were cut-away full-size models of an electric three-heat switch, an electric thermostat, a gas thermostat, a flanged tap, an interlocking pilot and main tap, some non-aerated (neat) gas burners, a ring burner, an aeromatic injector, a relay valve, a spreading flame burner, a gas governor, and a flame failure valve. The working of these instruments were clearly illustrated by diagrams in books which were open and placed at suitable points surrounding the stand.

The second stand displayed working models (supplied with gas from cylinders placed behind the stand) of a pressure governor, a cooker thermostat, a water heater burner assembly, and a glass-encased gas meter. There were accompanying diagrams and much-enlarged dials to illustrate the functioning of the meter.

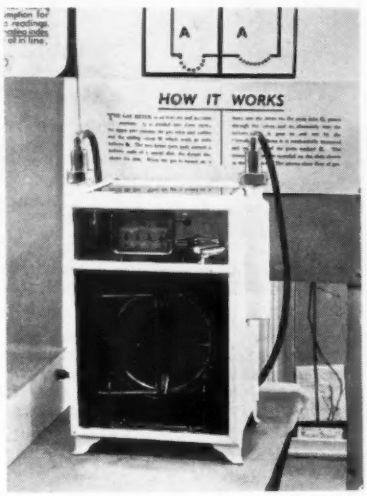
All the models were supplied by the North Thames Gas Board, and an official of the Board said: 'We run quite a thorough service in supplying technical colleges and secondary schools with such models—about 300 in all. Rather more, we believe, than any other Board. The demonstration meters—this particular one was manufactured by Willey and Co., Ltd.—are always in demand. The models are useful to demonstrate ordinary scientific experiments in schools. But apart from that, we believe that by their means a more general knowledge of gas appliances can be encouraged, resulting in their more efficient use and less accidents.'

Although the exhibition was arranged primarily for the interest of students in the department of mechanical and gas engineering, students from the other three departments, cookery, hotel operation, and civil engineering, have been encouraged to study the displays.

Mr. Wright, the Librarian, said: 'It would be a good thing if everybody understood how these things worked. After all, at least some of the appliances are installed in nearly every household in the country. But I feel that the cookery and hotel operation students, in particular, should know it.'

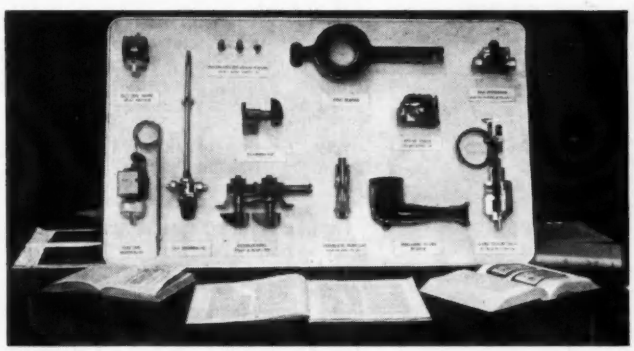
He said that from his point of view this exhibition, and others that he had in mind for the future, served a great practicable purpose. It was his job to encourage the students, and the staff of the college, to use the library as much as possible. Most students generally thought of the library as rather a dreary place. But if there were working models of anything at all in the library it would immediately seem livelier and the students would crowd in. Then they might be expected to take more interest in the books. 'That,' said Mr. Wright, 'has actually proved to be the case.'

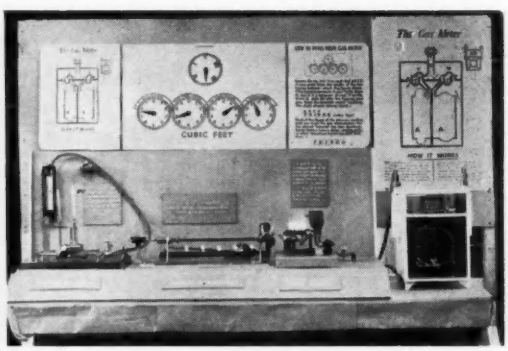
Mr. Wright said that he hoped for another outcome from the exhibition. Some help and interest had been supplied by the industry. If that interest could be broadcast throughout industry, colleges, and public libraries, so that similar, almost self-explanatory exhibitions might be arranged in every town, then understanding of domestic gas services would become more like a general knowledge rather than specialized knowledge. Mr. Wright added that he was indebted to the North Thames Gas Board for the valuable help which they had given him.



Above. A close-up of the glass-encased demonstration gas meter which, when working, attracted a great amount of attention.

Below: Left. The display of cut-away gas equipment together with books opened at appropriate pages to add descriptions.
Below: Right. Working models of gas equipment which were supplied with gas via the meter on the right.





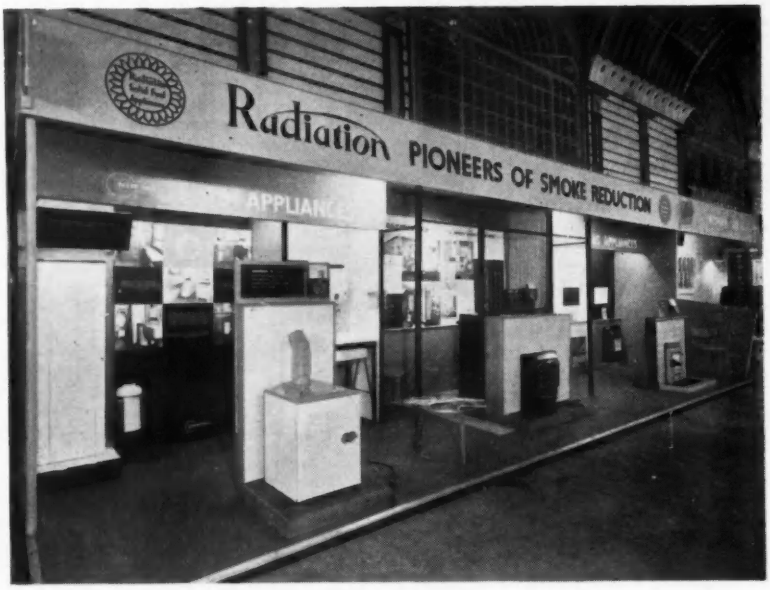
More Redundancy in Glasgow?

Between 70 and 100 of the 500 members of the clerical and administrative staffs employed by the Scottish Gas Board in the Glasgow district are threatened with redundancy as a result of recommendations made by efficiency experts to the Board, Mr. R. MacLean, president of the N.A.L.G.O., told a mass meeting of gas workers in Glasgow on November 4. This redundancy, he pointed out, would be additional to that involving 25 gas meter readers, who are to be dismissed as a result of the introduction, on January 1 next, of a new system under which meter reading surveys will be reduced from six to four a year.

Mr. H. Sutherland, another NALGO official, said it was not true that because of the work of the efficiency experts the ordinary consumer was going to enjoy a more efficient service. Mr. Sutherland contended that other jobs could be found within the gas industry for the redundant gas meter readers. There was work available for salesmen-canvassers, work which was at present being done by a private agency employed by the Board.

The meeting unanimously adopted a resolution demanding that the whole question of redundancy and reorganization, whether arising from the recommendations of efficiency consultants, or the policy of the Board, should be examined. It also sought definite assurances from the Board that all redundant employees would be retained on a supernumary basis until they could be absorbed by normal wastage or under a special arrangement agreed by the trade unions.

RADIATION AT NATIONAL HOUSING EXHIBITION



The Gas and Solid Fuel Divisions of Radiation Group Sales Ltd. combined to exhibit a selection of their latest space and water heating appliances on Stands Nos. 1, 2 and 3, part of which is shown in this photograph, at the National Housing and Town Planning Conference and Exhibition. The exhibition, which was held from October 26 to 28, was staged at the Corn Exchange, Royal Pavilion Estate, Brighton.

'DESIGN IN THE HOME' AT GLOUCESTER

An exhibition of domestic gas appliances, organized by the Cheltenham Division of the South Western Gas Board, entitled 'Design in the Home,' has recently been held at Gloucester. The exhibition was opened by His Worship the Mayor of Gloucester, Alderman E. J. Langdon, supported by the Mayoress, the City High Sheriff, Councillor J. F. Curtis and Mrs. Curtis. One of the highlights of the exhibition was a visit by Miss Josephine Douglas, the television star. This photograph shows Miss Douglas in the course of her tour of the exhibition. Left to right are Miss S. M. Green, Senior Home Service Adviser, Cheltenham Division, Mr. W. A. Chard, District Engineer and Manager, Gloucester, Mr. T. L. Tallentire, Divisional Engineer and Manager, Mrs. W. A. Chard, Mr. M. R. Webb, Divisional Commercial Assistant, and Miss Josephine Douglas.

South Western I.G.E. Annual General Meeting

The Annual General Meeting of the above Section was held at Swindon on October 19, 1955, and was presided over by Mr. W. B. Claridge, Chairman of the South Western Section of the I.G.E. Prior to the meeting luncheon was held at the Goddard Arms Hotel, Swindon, where members were the guests of Mr. C. H. Chester, C.B.E., Chairman, and Members of the South Western Gas Board.

The Section was honoured by the presence of the President of the Institution of Gas Engineers—Mr. W. K. Hutchison, C.B.E., who was welcomed in the toast 'The Institution of Gas Engineers,' submitted by Mr. W. B. Claridge, who referred to the fact that there were two Chairmen of Area Boards present —Mr. Hutchison, of the Southern Gas Board, and Mr. Chester, of the South Western Gas Board.

Election of Officers

At the subsequent meeting, held in the Demonstration Theatre, Temple Street, Swindon, Mr. Claridge occupied the Chair. Normal business of the Annual General Meeting included the election of the officers for the ensuing year, as follows: Chairman, Dr. A. Marsden, M.B.E., Bristol; Senior Vice-Chairman, Mr. T. L. Tallentire, Cheltenham; Junior Vice-Chairman (Acting), Mr. C. R. Ingham, Bristol; Immediate Past Chairman, Mr. W. B. Claridge, Swindon, and District Member of Council; and Hon. Secretary and Treasurer, Mr. E. V. Dunn, Devizes. Mr. O. Pincock, Torquay, and Mr. H. G. Stapley, Paignton, were elected to fill two vacancies as Ordinary Members of the Management Committee. Mr. L. Baldwin, Exeter, and Mr. O. H. W. Boonham, Cheltenham, were elected Honorary Auditors.

The Chairman referred to the resignation of the Honorary Treasurer, Mr. A. Holman Dunn, Newquay, who had acted as Honorary Secretary and Treasurer for four and six years, respectively. He was sorry that Mr. Dunn had found he was unable to continue as Honorary Treasurer and thanked him for his past services.

It was reported that at the Luncheon a collection from Members had provided £6, and the members voted 25 guineas from the Section's funds, both to be forwarded to the Benevolent Fund of the Institution. The Chairman presented to Mr. C. W. B. Luxton, Paignton, a second class Higher Grade Certificate in Gas Engineering (Manufacture). The retiring Chairman presented his address, which was well received by the members. Mr. C. H. Chester, who proposed a vote of thanks to Mr. Claridge, referred to the Address and the pleasure it had given members. He congratulated Mr. Claridge on a successful year as Chairman. Mr. Claridge then inducted Dr. A. Marsden, M.B.E., as Chairman for the ensuing Session, an honour which was well deserved. Dr. Marsden expressed his appreciation and thanked the members for his election. He then presented the retiring Chairman, Mr. Claridge, with a tea service as a memento of his year of office.

Proud owner of a gold half-hunter watch, presented to him to mark 40 years' service with the gas industry, is Mr. J. W. G. Jarvis, chauffeur to Mr. Henry F. H. Jones, Deputy Chairman of the Gas Council. Here, he shows his watch to his two colleagues, Mr. B. Hatt (left), chauffeur to Sir Harold Smith, and Mr. Percy Goldsmith, chauffeur to Mr. F. G. Brewer, Secretary to the Gas Council.

FORTY YEARS' SERVICE TO GAS COUNCIL

★

At the meeting of the Gas Council on November 2, Mr. J. W. G. Jarvis, the Deputy Chairman's driver, was presented with a gold half-hunter in recognition of 40 years' service in the gas industry. Mr. Jarvis entered the service of the Gas Light and Coke Company in September, 1915, and since nationalisation he has been in the service of the Gas Council. He started his duties driving a light van and after a short period he was transferred to coke lorries. In those days there were solid tyres. In World War I Mr. Jarvis served with the Royal Field Artillery. On his return he went back to driving coke lorries, but was later transferred to driving a light van on the "shuttle" service and then to private cars. He has driven Sir David Milne-Watson, Sir Edgar Sylvester and now Mr. Henry Jones. He holds the medals of the Royal Society for the Prevention of Accidents for 28 consecutive years' safe driving.

Advice on Showrooms

A combined meeting of the North Wales District Section I.G.E., the North Wales Section of the Wales and Mon. Junior Gas Association and the North Wales Sales and Service Association was held at the Mount Stewart Hotel, Rhos-on-Sea on October 29, when a paper was given to the three associations by Mr. A. Gordon, consulting architect to the Wales Gas Board on 'Showrooms'. Mr. Gordon's general theme was that the showroom as generally known should be called a shop and follow the same lines as that of the usual trader, that is to sell goods and in order to do so the shop must be made attractive which, he stated, was far from the case in quite a large number of cases. He emphasized his point with slides showing the different and more attractive method used by the Electricity Boards as compared with the somewhat feeble attempts made by some gas undertakings, he stated that the time had come to put the house in order as regards shops or showrooms and that the Wales Gas Board was now giving this matter their close attention. A poor shop or showroom in even the smallest undertaking reflected to the discredit of the Gas Industry as a whole. The shop or showroom he maintained was not only a shop window for the undertaking but also for the industry generally and the efficiency of that industry would be judged by the brightness and appearance of the way in which the goods they had to offer were displayed.

Discussion

In the discussion that followed several members took part and in the main, agreement with Mr. Gordon's views was expressed and it was generally agreed that the policy of cutting expenditure on showrooms and showroom staff would have to be revised especially in the light of the large expenditure spent on grid supplies which would rely on increased sales of appliances through the showrooms or shops to make them a success.

In proposing a vote of thanks to Mr. Gordon, Mr. O. P. Cronshaw, Engineer and Manager, Rhyl Undertaking and North Wales Grid Manager, said that the paper would have served a very useful purpose if only to bring home to the Managers of the various undertakings the importance of seeing that the best use was made of the showroom and that it was situated in the best place in the town. Mr. H. Blythe, Engineer and Manager, Colwyn Bay undertaking, in seconding the vote of thanks to Mr. Gordon also stressed the importance of increased sales of appliances.

At the conclusion of the meeting the members were entertained to tea by the courtesy of Mr. H. Blythe, Colwyn Bay Undertaking, Wales Gas- Board. A hearty vote of thanks was proposed and seconded to Mr. Blythe for his hospitality and for accommodating the meeting. The meeting was under the Chairmanship of Mr. H. Breeze, Chairman of the North Wales Juniors.

SALES AND SERVICE CONFERENCE

The platform party at the East Midlands Gas Board Sales and Service Conference held at Leicester recently. Left to right: Mr. Arthur Gwynne Davies, Mr. R. M. Stevenson, Mr. E. R. Pack, Esso Petroleum Co., Ltd., Mr. Sydney Smith, Chairman, East Midlands Gas Board, Mr. S. J. Perry, Board Member, and Mr. H. R. Hart, Commercial Manager, East Midlands Gas Board.

TRADE NEWS

New chemical pumps

The latest addition to the well-known line of pumps manufactured by Worthington-Simpson, Ltd., is a range of centrifugal chemical pumps having outstanding resistance to many acids, alkalis and slurries. The extent of the superiority of these pumps can perhaps best be gauged, it is claimed, by the fact that they are capable of handling sulphuric acid with a high degree of resistance, *i.e.*, a corrosion loss of up to 0.005 in. per year when made in *Worthite* —one of the two alternative materials of construction.

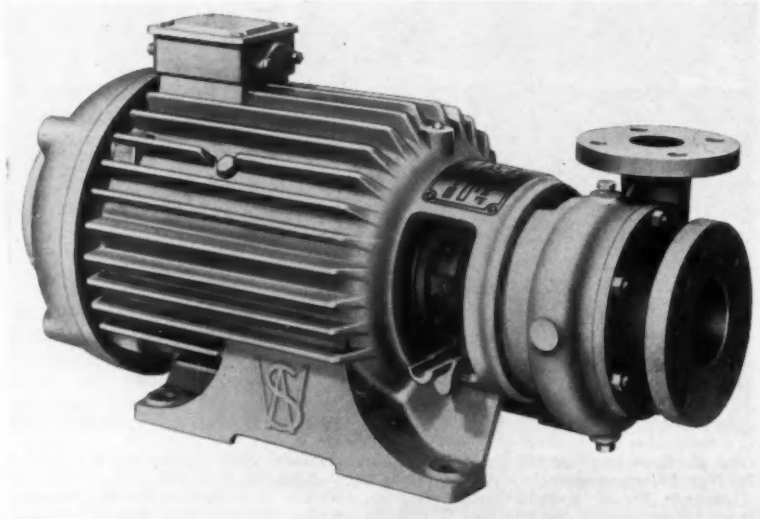
Worthite is a corrosion-resisting alloy steel which is said to be greatly superior to the standard austenitic steel, particularly in pumping sulphuric acid. Containing more than 50% of the alloying elements, the carbon content is kept below .07% to reduce to a minimum the tendency towards inter-granular attack or inter-crystalline corrosion.

The pumps are also constructed in 18/8/3 stainless steel which is claimed to be eminently suitable for mildly corrosive liquids. It is also advantageous where the liquid itself is non-corrosive, but no contamination or discoloration of the liquid is permissible—in many food or dyestuff processes, for instance.

An important feature of these pumps is that the pump casing remains the same whatever the seal used, and stuffing box packing or mechanical seals can be interchanged simply by the use of adaptors to suit varying liquids. The mechanical seals can be supplied to suit either Worthite or 18/8/3 stainless steel pumps, and are designed so that the stationary and rotating faces are kept together positively and any wear is taken up automatically.

The range covers a maximum output of up to 675 gal. per min. with heads up to 125 ft., depending on capacity. The maximum total suction lift at full capacities is—including all pipe and valve losses—15 ft. Up to 18 ft. suction lift can be obtained at lower capacities.

The Monobloc construction follows the method employed by this Company for many of their centrifugal pumps and air compressors and it is claimed to bring the advantage of such construction as an added feature, *i.e.*, a single shaft linking motor and pump, thus ensuring perfect and maintained alignment, while the necessity of providing separate driving motors, baseplates, belts, pulleys, and couplings is entirely eliminated.—*Worthington-Simpson, Ltd., Newark, Notts.*



Type DMC Monobloc chemical pump.

New poke welder

A poke welding device has been developed by The General Electric Co., Ltd., for use with its 4 kVA electronically-controlled spot welding machine. The device facilitates the spot welding of assemblies which are too large or too complicated to be accommodated in the machine, and allows reliable welding to be carried out when there is access to only one side of the metal.

The poke welding attachment has flexible cables with terminals at one end for connection to the welding machine. At the other end is a Paxolin cylinder carrying welding electrodes mounted side by side. In operation the cylinder is held in one hand, the electrodes are pressed upon the metal to be welded, and the welds are initiated by a push button switch. Two spot welds are effected simultaneously.

The welder has a wide range of applications, for example in the spot welding of furnace linings, tubes, and canisters made from very thin sheets of ferrous or non-ferrous metals.

The success of the new poke welder is claimed to be due to the cantilever method adopted for springing the electrodes and to the precision type of spot welding machine with which it is used. This machine was developed for spot welding very thin wires and sheets, particularly where dissimilar non-ferrous metals have to be joined. It supplies

The new G.E.C. poke welding device in use on crimped stainless steel sheet.

welding current in the form of heavy pulses of from one half to six cycles duration (1/100-12/100 sec.). The duration of the pulses is accurately timed electronically while a synchronizing circuit ensures that welds always start at the same instant in a supply cycle so that the exact performance of the machine will be repeated. The fully variable controls have graduated scales to allow settings to be recorded.—*The General Electric C., Ltd., Magnet House, Kingsway, W.C.2.*

Corrosion-resistant compound

An important new development in the field of corrosion-resisting compounds is the production of a fibre-reinforced plastic material which can be applied by brush on metal surfaces as an effective and economical protection against the corrosive effects of aggressive atmospheres, sea water, hydro-carbon products and a wide range of chemical agents, both in gaseous and liquid form.

The material, which will be of special interest to all those concerned with the maintenance of oil refineries, chemical processing plant and structural steelwork, consists of a mixture of a synthetic resin or latex with high-alumina cement, the whole being reinforced with a tough woven fabric by a patented process.

It is applied in two layers, interspersed with the woven fabric, to a total thickness of about $\frac{3}{32}$ in. It is cold setting, and the weight of the complete coating is approximately 9 lbs. per sq. yd. Very little preparatory treatment is required—which is a great advantage of this tech-

nique. It is sufficient to remove loose scale and rust by wire brush, and the presence of moisture does not impair the effectiveness of the application.

Because of the toughness of the layer produced, this 'V.G. Compound' is likely to be particularly applicable for structures composed of thin sheeting, since it will afford them extra strength as well as corrosion protection.

The compound is claimed to be impermeable and yet flexible, shows no softening at elevated temperatures and has a particularly good impact strength, comparing favourably in this respect with standard concrete. The adhesion strength is also very satisfactory.

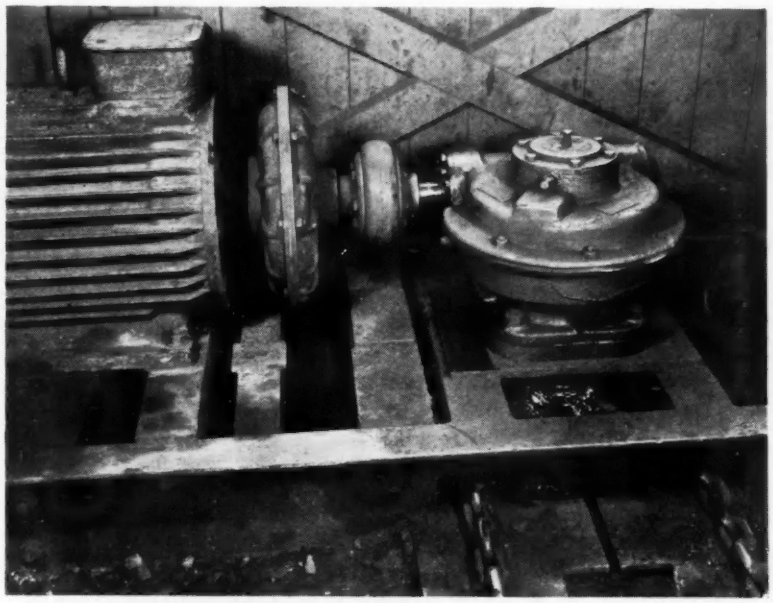
Extensive initial tests have confirmed the applicability of this interesting material in shipyards, and in oil refineries in this country and in France, in gas producing plants and also in sewage treatment works. One department of the Ministry of Works has reported very good results for containers coated with the compound and subjected to the corrosive action of formalin, and there are many obvious fields of application which are likely to be developed in the near future.—*V.G. (London), Ltd., 5-6, Newman Passage, Oxford Street, W.1.*

Powder couplings

A range of powder-type centrifugal couplings is made by Powder Couplings, Ltd., in conjunction with Stone-Wallwork, Ltd. The outer casing of the coupling is directly attached to the motor or other shaft and is driven by a key in the usual manner. Within the casing there is a disc-shaped rotor, the edge of which is formed alternately to one side and the other so that it presents a wavy appearance. This rotor is mounted on a sleeve which runs on plain bearings fitted on the casing hub, and the pulley for the driven machine is keyed to this sleeve. The inside surfaces of the outer casing, which is of die-cast aluminium, are sprayed with wear resistant metal and the steel rotor disc is case-hardened. The space between the casing and the rotor contains round chilled cast iron shot, mixed with graphite, the latter being included to provide lubrication, and to prevent excessive wear on the internal surfaces.

When the shaft on which the casing member is mounted starts to turn, the powder is thrown outwards by centrifugal force which gradually increases as the speed rises until the powder is packed sufficiently tightly to grip the rotor and to turn it. Normally the drive is taken up at 75 to 80% of the full motor speed so that the motor can be started under no-load conditions. After this point has been reached the slip between the casing and the rotor is gradually reduced until at full load, the powder becomes, in effect, solid, and no further slipping occurs. By varying the amount of the powder charge in the coupling the speed at which the powder becomes 'solid' can be varied to alter the drive take-up point.

Similarly, variations in the amount of powder enable the total power which the coupling will transmit to be varied. Any overloading of the motor above 20 to 25%, for example, can be eliminated by providing a powder charge such that slipping will again start under these conditions. Powder couplings are normally supplied in sizes to transmit from 0.1 to 250 h.p. at speeds from 700 to 3,000 r.p.m., but larger couplings can be made, if required, with capacities up to several thousand horsepower.



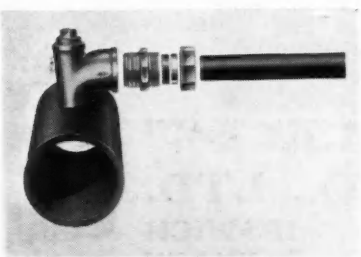
A powder coupling installation at Salford.

An interesting application of the powder coupling in the gas industry is provided at the Salford Station of the North Western Gas Board. A size 35 coupling is fitted to a 7.5 h.p., 720 r.p.m. motor which drives through a worm reduction gear to a long chain hauling coking cars. These cars weigh about 12 tons and carry 3 tons of coke at intervals of about 20 min. They are pulled before a water quenching system which distorts the car causing unknown friction which increases the load on the chain and the motor very considerably. It is found that the powder coupling is able to deal with the fluctuating load very satisfactorily and has given good service for more than two years.—*Stone-Wallwork, Ltd., 32, Victoria St., S.W.1.*

Titegrip 'Sweep Tee'

This fitting has been designed to give all the facilities of the normal service tee, with the following additional improvements. By increasing the size of the branch outlet it has been possible to incorporate a sleeve to house the rubber insert and metal sheath, this in turn accepts the branch pipe, which is held firmly and evenly by tightening the end nut. This compresses the rubber insert and gives a leak-proof joint.

This type of tee has the advantage, it is claimed, that there is no need for a springing branch pipe or turning fitting in the main to bring a branch pipe into the point of entry to make a connection. It also allows for a reasonable amount of misalignment and error in the length of the branch pipe without having to use an additional flexible coupling.—*Walter Slingsby & Co., Ltd., Keighley, Yorkshire.*



The Wask Titegrip 'Sweep Tee'.

Flexibility test

A feature of the Stanton Ironworks Co.'s stand at the 1955 British Trade Fair, held in Copenhagen, was a demonstration showing the degree of flexibility in the Company's screwed-gland flexible joint for cast iron pipelines. The joint was submerged in a water tank and held 50 lbs. per sq. in. air pressure. During the period of the Fair (September 29-October 16) the joint was deflected over 200,000 times. There was no loss of pressure.

The screwed gland flexible joint is available for pipe diameters up to 10 in. The bolted-gland flexible joint is for pipe diameters of 12 in. and above. Both joints permit up to 4° deflection.—*Stanton Ironworks Co., Ltd., Nottingham.*

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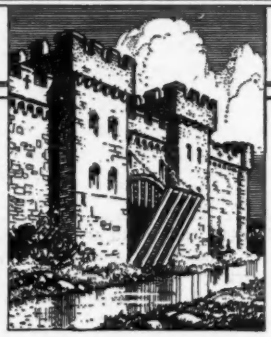

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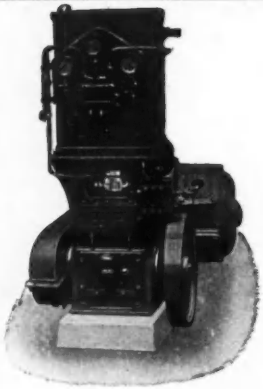

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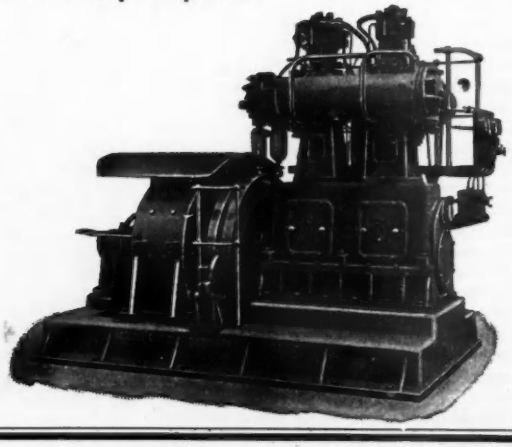
The compressor shown above has a capacity of 25 cu. ft. of free hydrogen per minute compressed to 3000 lbs./sq. inch. The illustration on the right shows a four-stage compressor with a delivered capacity of 200 cu. ft. of free town's gas per minute compressed to 5000 lbs. per sq. inch.



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APPOINTMENTS VACANT

The engagement of persons answering these advertisements must be made through a Local Office of the Ministry of Labour or a Scheduled Employment Agency if the applicant is a man aged 18-64 inclusive or a woman aged 18-59 inclusive unless he or she, or the employment, is excepted from the provisions of the Notification of Vacancies Order, 1952.

CHEMICAL ENGINEER required for interesting and varied work on the design and development of new chemical processes and plants allied to the Gas and Chemical Industries.

Applicants should preferably hold a degree in Chemical or Gas Engineering, A.M.I.Chem.Eng., or equivalent chemical qualifications, together with several years' practical experience. Unqualified applicants will be considered if they have considerable experience of chemical plant design and operation, preferably in the fields of solvent extraction, heat transfer or processes connected with the Gas or allied industries.

The salary would be fully commensurate with the qualifications and experience. The position is permanent, and the Company operates a Staff Pensions Scheme and a five-day week.

Reply giving age, qualifications and full details of experience and type of work carried out, together with some indication of salary required. Applications should be addressed to No. 263, *Gas Journal*, 11, Bolt Court, Fleet Street, London, E.C.4, and will be treated in confidence.

SOUTH EASTERN GAS BOARD

ASSISTANT CHEMIST, GLYNE GAP WORKS, HASTINGS
Sussex Division

APPLICATIONS are invited from men with experience in chemical control of gasworks processes and having educational qualifications equivalent to at least the General Certificate of Education in Chemistry at Advanced Level.

Salary within Grade 5 (Prov. 'A')—£530-£610 p.a.

Applications in writing, quoting reference V10/601 and giving full details should reach the undersigned within fourteen days.

R. J. McRAE,
Personnel Manager.

Katharine Street,
Croydon.

EASTERN GAS BOARD

IPSWICH DIVISION
ASSISTANT WORKS MANAGER—CHELMSFORD

APPLICATIONS are invited from qualified men for the position of ASSISTANT WORKS MANAGER at the Chelmsford Gas Works.

The salary will be in Grade 9 (Provincial 'A' of the A.P.T. scales) (£700/£800 per annum).

The successful candidate may be required to pass a medical examination and, unless already subject to a pension scheme by virtue of the Gas (Pension Rights) Regulations, 1950, will be required, if eligible, to join the Board's Staff Pension Scheme within six months from taking up the appointment.

Applications, stating age, qualifications and experience, together with the names of two referees, should be addressed to the undersigned to reach him not later than Saturday, November 26.

W. J. COLLINS GARRARD,
Divisional General Manager.

Crane Hill Lodge,
London Road,
Ipswich, Suffolk.
November 5, 1955.

WALES GAS BOARD

SENIOR ACCOUNTANCY ASSISTANT,
NEWPORT UNDERTAKING

APPLICATIONS are invited for the above appointment. The person appointed will be Senior Assistant to the Accountant of the Newport Undertaking/Group Accountant, Newport Group.

Candidates should possess a secretarial and/or accountancy qualification and be fully experienced in public utility accountancy work, including all subsidiary records and final accounts; mechanised accounting including billing, wages, stores and nominal ledger; office organisation and control of staff.

The salary will be in accordance with A.P.T. 9 of the National Salary Scales (£700/£800 per annum). The post is pensionable.

The successful candidate may be required to pass a medical examination.

Applications stating age, qualifications and experience, together with the names of two referees, should reach the undersigned not later than 14 days from the appearance of this advertisement.

J. F. RUST,
General Manager and Engineer.

Wales Gas Board,
Newport Undertaking,
Mill Street,
Newport.

WEST MIDLANDS GAS BOARD

NORTH STAFFORDSHIRE DIVISION
DIVISIONAL INDUSTRIAL GAS STAFF

APPLICATIONS are invited for the following posts:

INDUSTRIAL GAS REPRESENTATIVE

Candidates should have experience in industrial and commercial gas utilisation and a knowledge of the comparative costs and merits of other fuels.

Possession of the Institution of Gas Engineers, Higher Grade Certificate in Gas Engineering (Supply) or equivalent qualification would be advantageous.

The salary will be within Grade 8 (£660-£740 per annum) of the National Salary Scales.

TRAINEE INDUSTRIAL GAS REPRESENTATIVE

Candidates should have suitable basic training, personality and qualifications and be interested in a career on the industrial side of the gas industry.

The person appointed may be expected to follow a course of training.

The salary will be within Grade 4 (£365-£555 per annum) of the National Salary Scales for Gas Staffs.

These appointments are pensionable, and the successful candidates may be required to pass a medical examination.

Applications, stating age, qualifications and experience, together with the names of two referees, should be addressed to Mr. J. E. Stanier, Divisional General Manager, West Midlands Gas Board, Etruria Gas Works, Stoke-on-Trent, to reach him not later than November 30, 1955.

J. C. INGRAM,
Secretary to the Board.

WEST MIDLANDS GAS BOARD

WARWICKSHIRE DIVISION
HOME SERVICE ADVISER, RUGBY DISTRICT

CANDIDATES should have had at least two years' training in Domestic Science and hold an appropriate Diploma or Certificate.

The salary for the post will be within Grade 4 (£326-£450 per annum) or 5 (£430-£494 per annum) of the National Salary Scales for Gas Staffs according to age, qualifications and experience.

The post is pensionable, and the successful candidate may be required to pass a medical examination.

Applications, stating age and giving details of training and experience, together with the names of two referees, should be addressed to Mr. A. Allen, Divisional General Manager, West Midlands Gas Board, Gas Street, Coventry, to reach him not later than November 26, 1955.

J. C. INGRAM,
Secretary to the Board.

WEST MIDLANDS GAS BOARD

NORTH STAFFORDSHIRE DIVISION
CHIEF CLERK
LEEK DISTRICT

THE person appointed will be responsible for the supervision of the staff engaged on the clerical, accountancy and costing work of the District and practical experience of office organisation and stores control will be essential.

The salary will be in accordance with Grade 8 (£660-£740 per annum) of the National Salary Scales for Gas Staffs.

The post is pensionable, and the successful candidate may be required to pass a medical examination.

Applications stating age and giving full details of qualifications and experience, together with the names of two referees, should be addressed to Mr. J. E. Stanier, Divisional General Manager, West Midlands Gas Board, North Staffordshire Division, Etruria Gas Works, Stoke-on-Trent, to reach him not later than November 23, 1955.

J. C. INGRAM,
Secretary to the Board.

WEST MIDLANDS GAS BOARD

WOLVERHAMPTON AND DISTRICT DIVISION
TECHNICAL ASSISTANT
STOURBRIDGE (SOUTHERN GROUP)

CANDIDATES should preferably have experience of the control and working of Woodall-Duckham vertical retorts, automatic water gas plants and the manufacture of concentrated liquor. The successful applicant will normally be employed at the Stourbridge Works, but may be required to undertake duties at other Works in the Group.

The salary will be within Grade 5 (£530-£610 per annum) of the National Salary Scales for Gas Staffs.

A house adjacent to the Works will be available for the person appointed, at a reasonable rental.

The post is pensionable, and the successful candidate may be required to pass a medical examination.

Applications stating age and experience, together with the names of two referees, should be addressed to Mr. Stanley Jones, Divisional General Manager, West Midlands Gas Board, Wolverhampton and District Division, Kensington House, Bath Street, Dudley, to reach him not later than November 23, 1955.

J. C. INGRAM,
Secretary to the Board.

WEST MIDLANDS GAS BOARD

BIRMINGHAM & DISTRICT DIVISION
CHIEF CLERK
DIVISIONAL ACCOUNTANT'S OFFICE,
BRASSHOUSE PASSAGE

THE successful candidate will be responsible for supervising the Divisional Accountant's general office; maintaining a system of internal check particularly in relation to wages, petty cash and sales of residuals; assisting in the compilation of budgets and final accounts; and ensuring liaison with all sections including staff at Works.

The ability to initiate and carry out special investigations is desirable, as also is some knowledge of mechanised accounting systems, particularly punched-card. A professional qualification will be an advantage.

The salary will be within Grade 12 (£835-£960 per annum) of the National Salary Scales for Gas Staffs.

The post is pensionable, and the successful candidate may be required to pass a medical examination.

Applications stating age, qualifications and experience and present position, together with the names of two referees, should be addressed to Mr. J. E. Wakeford, Divisional General Manager, West Midlands Gas Board, Birmingham and District Division, Gas Offices, Edmund Street, Birmingham 3, to reach him not later than November 23, 1955.

J. C. INGRAM,
Secretary to the Board.

(*Classified advertisements continued on pages* 481, 482)

KARACHI GAS COMPANY LTD.

PAKISTAN

The above Company has been formed to distribute and sell natural gas for power generation, general industrial use and public supply; and applications are invited for appointments to posts in the following groups on the basis of an initial three-year contract. Attractive salaries, with free accommodation (bachelor and married) and other benefits.

★

SENIOR EXECUTIVE APPOINTMENTS

Posts include those of General Manager, Chief Engineer, and Industrial Gas Engineer. Candidates must have experience in the distribution and utilization of gas and the management of departments, and should be Corporate Members of The Institution of Gas Engineers.

TRAINING APPOINTMENTS

Candidates must have experience in training in gas utilization, particularly for industrial applications, and should hold the City and Guilds Final Certificate in Gas Fitting.

GAS FITTING APPOINTMENTS

Candidates must have had wide practical experience in the installation and maintenance of industrial gas equipment and/or of equipment and instruments used to control and meter gas.

★

Applications, giving age, education, qualifications and details of posts held and experience should be addressed to No. 265, "*Gas Journal*," 11 *Bolt Court, Fleet Street, London, E.C.4.*

There was nothing one-eyed about Nelson . .

. . when it came to victory at sea, but many people with normal sight have a blind spot about photography. The fact is that instead of going to any old photographer, it *pays* you to go to an expert because the results are exactly what you want. If you consult **Walter King Photographs,** 11, Bolt Court, Fleet Street, E.C.4. (Telephone FLEet Street 2236) you will find their prices are no more. As for their work—well, you can see the difference with half an eye.

WALTER KING WK PHOTOGRAPHS

The sign of BETTER Photography

APPOINTMENTS VACANT (*ctd.*)

SOUTH WESTERN GAS BOARD

PENZANCE UNIT
APPOINTMENT OF TECHNICAL ASSISTANT

APPLICATIONS are invited for the above post within the Plymouth and Cornwall Division at Penzance Unit. The salary will be within Grade APT. V Prov. A £500 to £580 according to experience and ability.

Applicants should have had good all round training and experience in gas manufacture, and for preference should be Associate Members of the Institution of Gas Engineers.

Applications, together with the names of two referees, should be received by the undersigned not later than December 17, 1955.

H. G. STAPLEY,
Area Assistant Engineer,
Devon and Cornwall.

South Western Gas Board,
Hollacombe,
Paignton, Devon.

NORTH THAMES GAS BOARD

A DRAUGHTSMAN is required in the Chief Engineer's Department, Gasworks, Beckton, East Ham, E.6. Candidates should be conversant with general Process and Structural work on a Gas Manufacturing Station, and possess the Higher National Certificate in either Mechanical or Structural Engineering, or an equivalent qualification.

Starting salary, according to age, qualifications and experience, within the range £650 to £730 per annum. The successful candidate will be required to join the Staff Pension Scheme.

Applications giving age and full particulars should be sent to the Staff Controller, North Thames Gas Board, 30, Kensington Church Street, W.8, quoting reference 666/300.

SCOTTISH GAS BOARD

LANARKSHIRE DIVISION
SENIOR TECHNICAL ASSISTANTS

(a) Airdrie District Undertaking.

(b) Hamilton Gas Works.

APPLICATIONS are invited for the above two appointments. The successful candidates will be responsible for the technical control of the Gas Production Plant in the respective Works and should have a thorough working knowledge of Continuous Vertical Retorts and Ancillary Gas Works Plant.

Candidates should be, or about to qualify for, Corporate Membership of the Institution of Gas Engineers. Both appointments carry a salary of Provincial 'A' A.P.T. 6 (£565-£645 per annum) with placing according to qualifications and experience.

Applications endorsed "Senior Technical Assistant" giving the names of two referees and full particulars of education, training and experience should reach the undersigned not later than Monday, November 21, 1955.

JAMES M. DOW,
Divisional Controller.

Divisional Offices,
Bothwell Road,
Uddingston.
November 3, 1955.

SCOTTISH GAS BOARD

KILMARNOCK GROUP
NEWTON-ON-AYR DISTRICT
TECHNICAL ASSISTANT

APPLICATIONS are invited for the position of TECHNICAL ASSISTANT to the Newton-on-Ayr Gas Undertaking.

Applicants should possess the Leaving Certificate of the Education Department to the standard required by the Engineering Joint Examination Board for exemption from the common Preliminary Examination, or equivalent, or the Ordinary National Certificate of one of the Engineering Institutions. Applicants must be prepared to follow an appropriate course of study leading to an approved qualification in Gas Engineering.

The salary offered will be in accordance with the National Joint Council Scales for Gas Staffs, Grade 2/3, £360-£535 per annum with placing according to qualifications. The post will be superannuable and the successful applicant will be required to pass a medical examination.

Applications, giving age and full details of training and experience, should reach the undersigned within 14 days of the appearance of this advertisement.

Copies of Testimonials should be submitted, or the names of two persons to whom reference can be made.

C. E. N. FRESHNEY,
District Manager.

Gas Works,
Newton-on-Ayr.

SCOTTISH GAS BOARD

FIFE GROUP—DUNFERMLINE DISTRICT
WORKS SUPERINTENDENT

APPLICATIONS are invited for the appointment of WORKS SUPERINTENDENT at Dunfermline Gas Works.

The successful applicant will be responsible to the District Manager for the supervision of the running of the Works. The Plant to be controlled is Woodall-Duckham Vertical Retorts and C.W.G. Plant with Ancillary Units.

The salary for the position will be fixed on Provincial 'A,' A.P.T. 6, *i.e.*, £565 to £645 yer annum, plus a free house. The house is a modern one of five apartments with all modern conveniences.

Applications, giving full particulars of qualifications and previous appointments held, together with names of two referees, and endorsed "Works Superintendent," to be lodged with the undersigned not later than November 30, 1955.

DAVID L. DICKSON,
Group Manager.

Gas Offices,
Grange Road,
Dunfermline.

BRITISH COKING INDUSTRY ASSOCIATION requires Technical Assistants at a new station for testing coke-using appliances to be opened shortly in Acton, London, W.4. Applicants should have some previous laboratory experience. The posts are superannuable under the Association's Pension Scheme and are offered at salaries within the range £550-£650 per annum.

Applications in writing giving details of previous experience and qualifications should be sent to the Secretary, British Coking Industry Association, 74, Grosvenor Street, London, W.1.

DOMESTIC UTILISATION OF GAS

SMITH & LE FEVRE

20/- *inc. postage*

WALTER KING, LTD.

11, Bolt Court, Fleet Street,

E.C.4.

PLANT FOR SALE

FOR SALE: NEW GAS-FIRED BOILER by Hartley & Sugden. 160 lbs./hour at 80 lbs. p.s.i., complete with chimney, spare burner and controls. Original purchase price was £419. Our price £200. W. H. COLLINGBOURNE & CO., LTD., 1481, Stratford Road, Birmingham, 28. Phone: Shirley 3303.

PATENTS

KINGS PATENT AGENCY, LTD.

(Director, B. T. King, A.I.M.E., Patent Agent) Advice, Handbook, and Consultations free. 146a, Queen Victoria Street, London, E.C.4. 'Phone: City 6161.

STRINGER BROTHERS

ALBION WEST BROMWICH

S.B IRON & STEEL PLATES & SHEETS BARS & SECTIONS

Telephone: WEST BROMWICH 0436-7

For high efficiency gas cleaning

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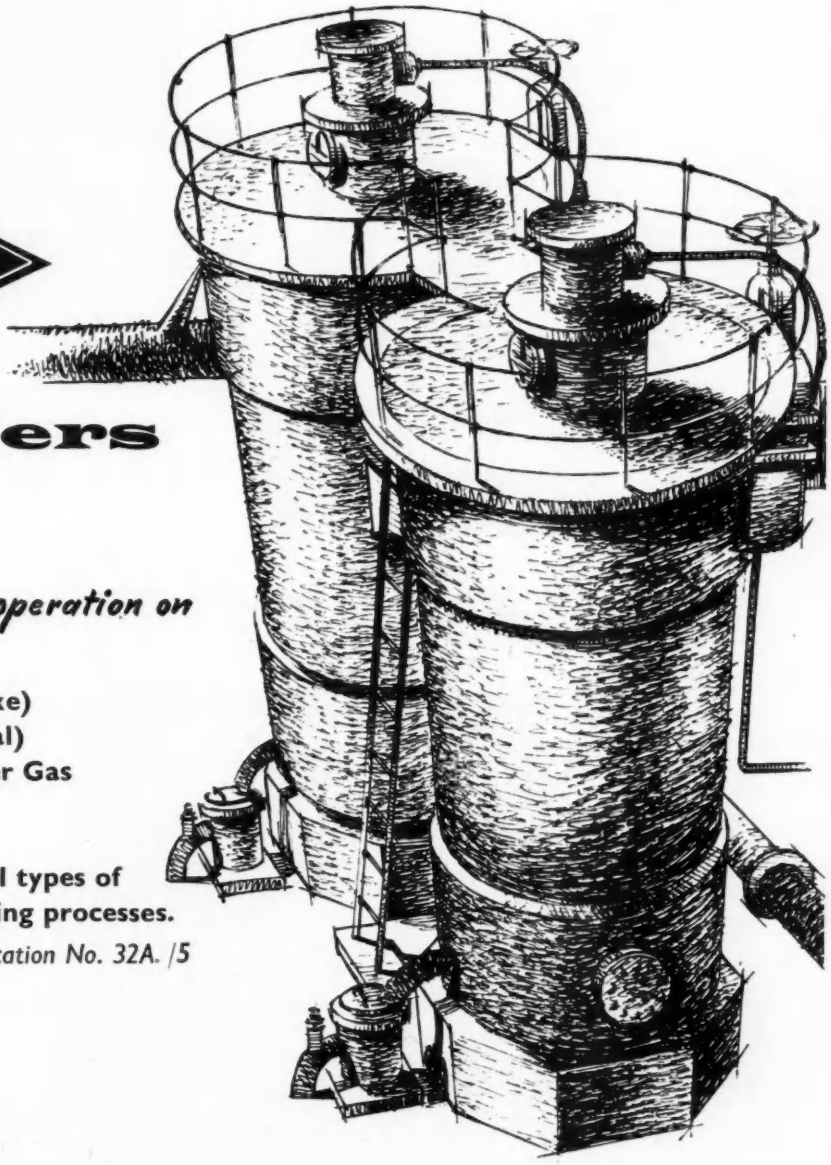


Designed for operation on

Coal Gas
Producer Gas (Coke)
Producer Gas (Coal)
Carburetted Water Gas
Oil Gas
Coke Oven Gas
and particularly all types of
Cyclic Gas producing processes.

Please write for Publication No. 32A. /5

W. C. HOLMES & CO LTD
TURNBRIDGE - HUDDERSFIELD

©4723

industrial gas compressors

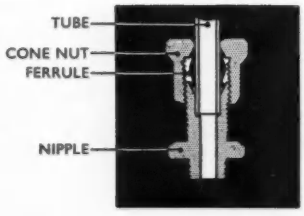
FOR COMPRESSING AIR OR GAS SUPPLIES USED FOR FURNACE HEATING, METAL MELTING, BRAZING, SOLDERING BITS, LAUNDRY IRONS, ETC.

DIRECT COUPLED COMPRESSORS (see illustration right) are fitted with automatic internal by-pass valves and lubrication systems. They are direct coupled to Keith Blackman motors. Type OA compressors in this range occupy a floor space of only 18" x 7½".
CAPACITY RANGE: 100 to 750 cub. ft. of gas or air per hour at 3 lbs. per sq. in. pressure.

TYPE 4 COMPRESSORS (not illustrated) are also fitted with automatic internal by-pass valves and lubricators. The complete unit includes motor and drive on a common bedplate, all of Keith Blackman manufacture.
CAPACITY RANGE: 500 to 20,000 cub. ft. of gas or air per hour at 3-5 lbs. per sq. in. pressure.
AREA OCCUPIED: from 9¼" x 16½" to 61" x 27".

DID YOU KNOW?

KEITH BLACKMAN have been making compression joints for many years and the present design embodies features developed as a result of this long experience. Notice that the shape of the ferrule is such that the joint is made without unduly stressing the tube.



Keith Blackman LIMITED
MILL MEAD ROAD, TOTTENHAM, LONDON, N.17
'Phone: Tottenham 4522 (twelve lines). 'Grams: "Keithblac, Norphone, London."
BRANCH OFFICES AT MANCHESTER, BIRMINGHAM, LEEDS, GLASGOW, NEWCASTLE-ON-TYNE, PENARTH near CARDIFF, AND BELFAST

serving to burn

Note: the four burner heads (right) are for high pressure gas, or low pressure gas and air blast.

LEFT: "Fishtail" type burner with two-armed stamped pattern injector for heating liquid in tanks by submerged combustion tubes. For use with low pressure gas supplies.
Size Range: 1", 1¼", 1½", 2" and 2½" outlets.
Capacity Range: 45-280 cub. ft. of gas per hour.

Brass non-blow-off head types: deal with 5 to 10 cub. ft. of gas per hour.

Stainless steel, "F" type head, burner: deals with 8 cub. ft. of gas per hour.

Perforated head type burner: deals with 10 to 15 cub. ft. of gas per hour.

INDUSTRIAL GAS EQUIPMENT

524

TRACKS FOR Mr. Therm

Litchurch Gas Works Sidings:— carried out for the East Midlands Gas Board under the direction of A. W. Elliott, Esq., M.Inst.F. — were constructed by Grant, Lyon & Co., Ltd., in five months and comprise three miles of standard gauge track, using 95 lb. R.B.S. Bullhead material, and 21 turnouts. The layout consists of eight parallel tracks with one loop road and connects with the works across the old Derby Canal.

Grant, Lyon & Co., Ltd., have a special division dealing solely with railway sidings construction and maintenance, with technical drawing office facilities backed up by fully skilled platelaying gangs supervised by men trained to British Railways standards.

Other activities cover reinforced concrete construction and foundation work, earth moving, heavy drainage, marine works, and soil stabilisation.

Your enquiries for any of the foregoing are invited.

GRANT LYON
AND COMPANY LIMITED
SCUNTHORPE

Railway and Civil Engineering Contractors. Head Office: Scotter Road, Scunthorpe, Lincs. Phones: Scunthorpe 2308/9; Manchester DEAnsgate 7805; Swansea 2519.

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WEST'S

CARBONIZING SYSTEMS

WEST'S GAS IMPROVEMENT CO. LTD

OFFERS :—

GLOVER – WEST

CONTINUOUS VERTICAL RETORTS

C.O.L.

INTERMITTENT VERTICAL CHAMBERS

COLLIN

COKE OVENS

WEST'S GAS IMPROVEMENT CO. LTD
ALBION IRONWORKS · MILES PLATTING
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Telephone: COLlyhurst 2961 Telegrams: Stoker, Manchester

AND IN LONDON:—
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C.O.L. Div: Chandos House, Buckingham Gate, S.W.1. Tel: ABBEY 6912

G1

NEAT

FA-NEAT GAS COOKING RINGS *never light back!*

FA NEAT COOKING RING
Type FA/1
Light and compact. Finished in grey vitreous enamel or cream at small extra cost. Available with two rings — type FA/2.

FA NEAT UNIT BURNER
Type FA/4
Sturdily constructed appliance that will stand up to hard usage. Standard grey finish. 2, 3 and 4 units.

FA NEAT TWO-BURNER HOTPLATE — Type FA/4/2
This is an extension of the Single-Burner Hotplate and incorporates the same features. Ideal for casserole cooking or general uses.

✳ **However low gas jet is turned, it will not "pop back".**

✳ Robust construction and vitreous enamel finish combine long life with elegance.

✳ The burner is silent whatever the setting of the tap.

✳ Pan supports are removable for easy cleaning.

These handsome FA Neat gas hotplates are extremely useful in house, flat or bed-sitting room. Clean, efficient and economical, they are fully capable of cooking a simple casserole meal or for use as a general purpose appliance.

ASCOT

ASCOT GAS WATER HEATERS LIMITED · 255 NORTH CIRCULAR ROAD · NEASDEN · LONDON N W 10

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